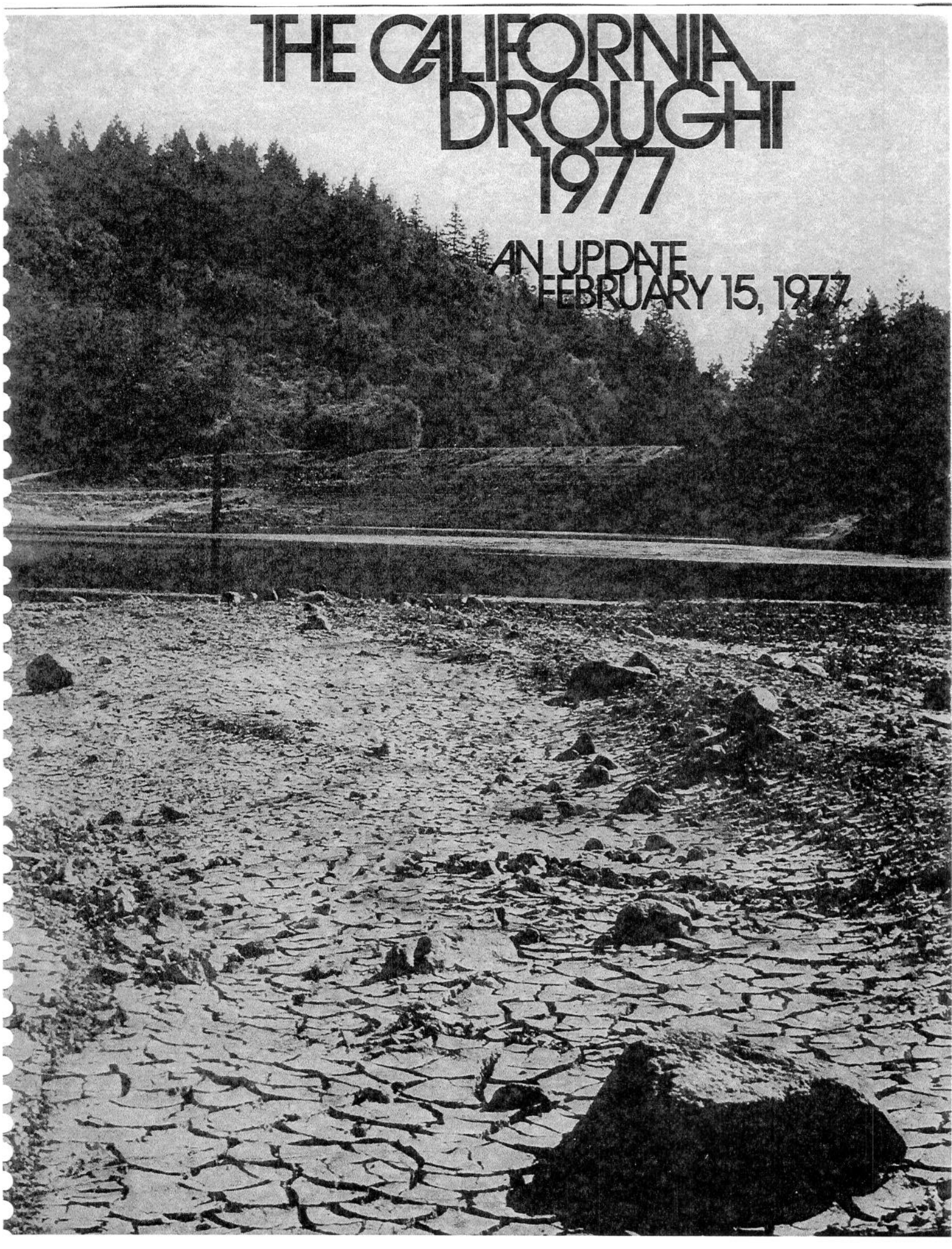
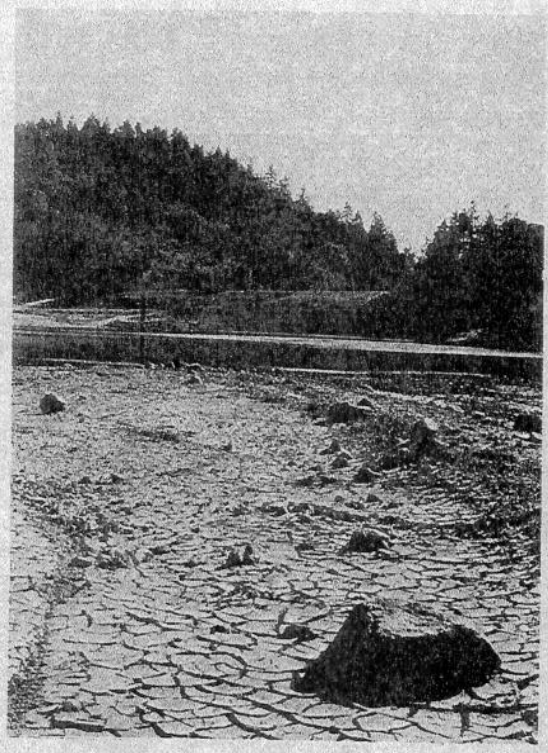
THE CALIFORNIA DROUGHT 1977

AN UPDATE FEBRUARY 15, 1977





ON THE COVER: Typical scene in Northern and Central California in early 1977. Nearly empty Bell Reservoir, near St. Helena. Photo courtesy of Linda Moran and the St. Helena Star.

State of California
The Resources Agency
Department of Water Resources

The California Drought - 1977
An Update

February 15, 1977

FOREWORD

The year 1976 was the third driest of record in California. It is clear now that 1977 will be as dry as, or drier than, the worst year, 1924.

Already significant rationing is under way in many parts of the State, and substantial deficiencies have been imposed by federal, state, and local water projects. Most hard hit are agricultural users. Many actions have been taken by the State in conjunction with federal, state, and local agencies to alleviate emergency situations. These include a transfer to Northern California of substantial quantities of Metropolitan Water District water entitlements from the State Water Project and an historic interconnection of East Bay water systems, including an arrangement to transport Metropolitan Water District exchange water to Marin County.

Much more needs to be done. Every individual in our State and every agency supplying urban water must take actions immediately to substantially reduce water use, not only to meet current needs but to ensure the largest possible carryover supplies for next year - which may also be dry.

This report, prepared by the State Drought Information Center, in cooperation with federal, state, and local agencies, summarizes the impact of the drought in 1976 and brings up-to-date the status of drought conditions in 1977. (Data is current as of February 15, 1977.) Additional reports will be issued periodically as conditions change.

Managing water resources during the current drought will place substantial obligations on and require sacrifices by individuals and government alike.

As Governor Edmund G. Brown Jr. said, in his message to the Legislature on January 6, 1977, "We are going to have to learn to share, north and south, all of us together. It is the only way we can solve this problem."

Ronald B. Robie

Ronald B. Robie, Director
Department of Water Resources
The Resources Agency
State of California
February 15, 1977

State of California
The Resources Agency
Department of Water Resources

The California Drought - 1977

Figures

Tables

Appendix

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SPECIAL ANNOUNCEMENT

On February 25, 1977, as this report was going to press, the Department of Water Resources completed its allocation of 320,000 acre-feet (395 cubic hectometres) of water released by the Metropolitan Water District of Southern California in an exchange agreement signed February 10, 1977. The water, allocated after a joint public hearing by the Department, the Department of Food and Agriculture, State Water Resources Control Board, and the California Water Commission, became available when MWD agreed to increase its pumping from the Colorado River in 1977 and reduce its demand on the State Water Project. The Department received requests for water totaling 843,472 acre-feet (1,040 cubic hectometres).

The allocated water will be provided to urban users for domestic, sanitary, health, and fire protection uses where mandatory conservation of at least 25 percent is in effect, to agricultural users not served by the State Water Project for emergency supplies to maintain survival of permanent crops if they do not have an alternative supply, and to State Water Project agricultural users.

Approximately 28,800 acre-feet (35 cubic hectometres) will be provided to the San Francisco Bay urban areas and 291,200 acre-feet (360 cubic hectometres) to agricultural users, mainly in the San Joaquin Valley, including 20,250 acre-feet (25 cubic hectometres) for areas not served by the State Water Project. The latter amount will be allocated and served by the U. S. Bureau of Reclamation through the federal Central Valley Project and other facilities.

SETTING THE SCENE: THE STATEWIDE WATER PICTURE IN 1976

The year 1976 will be remembered as one of the exceptionally dry years in California history. In this century, only 1924 and 1931 were as dry. Californians must remember, however, that conditions of 1976 are not unique: similar (or worse) conditions have occurred before and they will happen again. What is described as "unusual" or "exceptional" weather is merely an extreme of the normal.

We have had droughts before: in 1827-29, 1856-57, 1863-64, and 1929-34. The 1863-64 drought, the driest ever recorded in Southern California, brought an end to the beef industry there. The 1929-34 drought, the longest in the Sacramento River basin in 125 years of record, has gained the distinction of serving as the model for water supply availability to most modern Northern California water projects.

The Causes - Weather Patterns and Precipitation

Early in November 1975, a high-pressure ridge established itself over the ocean between Hawaii and California. Month after month, all winter long, it persisted. Most winter storms were shunted to the north, over Oregon and Washington. Those which broke through were so weakened that little moisture was left for California. Nearly every station in the State reported below normal precipitation, although deficiencies were most notable in an east-west swath across the central part of the State.

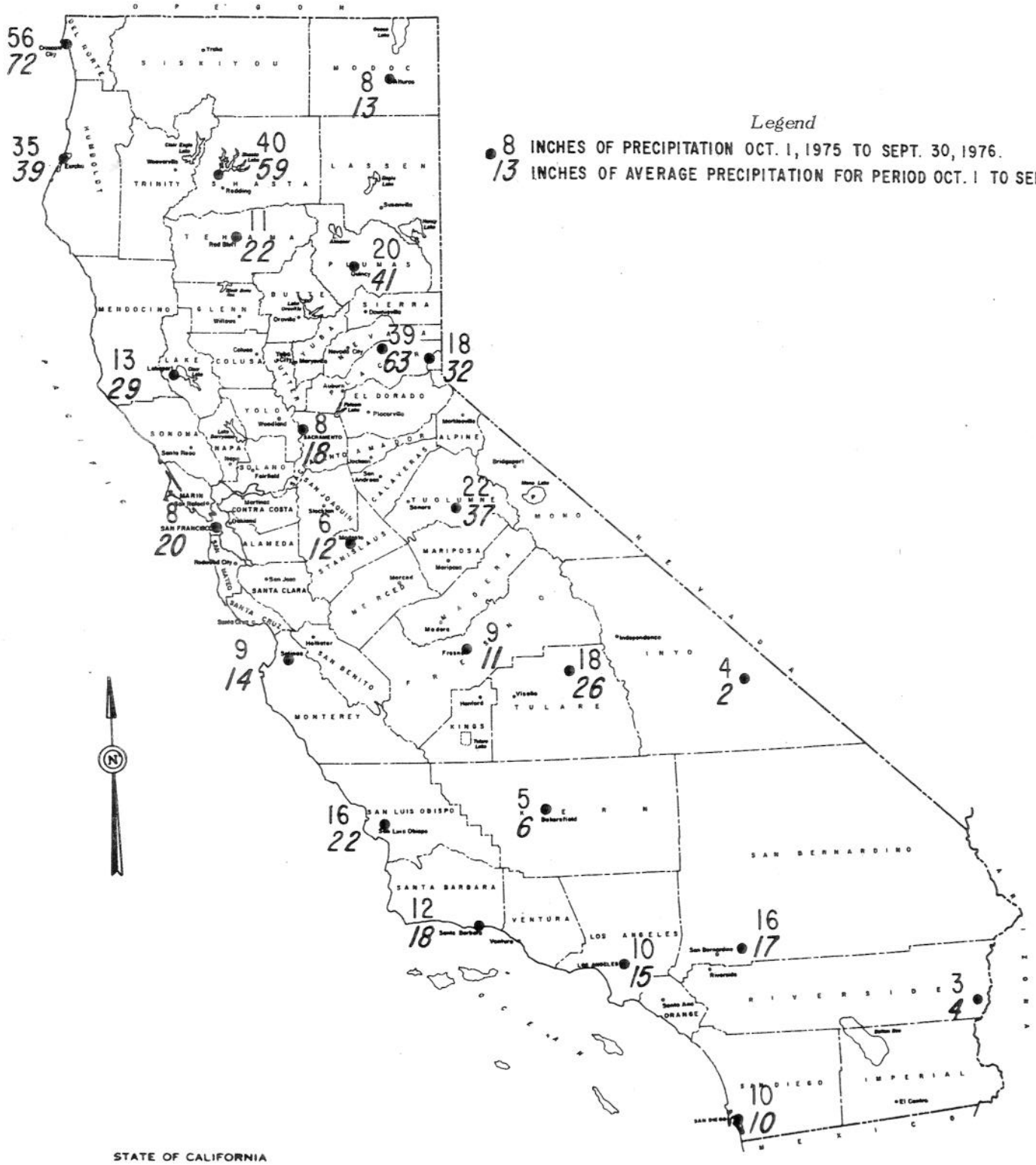
Precipitation in California was previously documented in the "California Drought - 1976" report for the period October 1, 1975, to May 1, 1976. Figure 1 updates some of these figures to show last year's precipitation (from October 1, 1975, to September 30, 1976) compared to the average at selected locations in the State. For a large part of the central region, seasonal precipitation amounted to only 30-50 percent of normal. The dearth of rain and snow led to a number of dry year records or near records for stations throughout the central part of the State. Several storms in August and September boosted the water year figures but were too late for a substantial contribution to this year's beneficial use. Their adverse effect on the State's crops far outweighed their benefits.

Snowpack and Runoff

The meager winter storms left little snowfall. By April 1, 1976, the snowpack's water content was the lowest of record at about one-third of the State's snow courses. Snowmelt began about mid-March and in many basins was essentially complete by May 15, 1976, much earlier than usual since the snowmelt often extends through much of July.

FIGURE 1

PRECIPITATION OCTOBER 1, 1975 TO SEPTEMBER 30, 1976



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

SCALE OF MILES
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Low rainfall and sparse snowpack resulted in greatly reduced runoff to our rivers and streams. Figure 2 illustrates 1976 water year runoff in terms of the normal for the State's major upland basins. New record low runoff amounts were set for many Central State streams and rivers. In the Central Valley's Sierra basins, runoff amounts ranged from a high of 43 percent of normal for the Feather River to a low of 16 percent for the Cosumnes. On the Central Coast, the situation was even worse with all coastal streams registering 10 percent or less of normal. The Russian River had only 15 percent of normal runoff.

Reservoir Storage

The April-July period inflows to Folsom, Pardee, New Don Pedro, Millerton, Exchequer, and Stanislaus River reservoirs were either the lowest of record or nearly so. Table 3 in our May report detailed storage in the State's major reservoirs as of May 1, 1976. When compared to the average storage for that time of year the figures do not appear startlingly low (for example, Central Valley storage was 83 percent of normal, with its Sacramento Valley portion at 77 percent and the San Joaquin Valley portion at 95 percent). However, such figures do not reflect the lack of runoff due to the meager snowmelt. Table 1 presents a comparison of the 1976 unimpaired runoff of selected streams with the average for past years. It illustrates the bleak picture faced at the beginning of the irrigation season this past year.

During the summer of 1976, reservoirs throughout the State were drawn down to record lows. Although resulting in losses to this year's farm industry, the rains and cool weather of August and September prevented reservoir drawdown of larger magnitude. Even so, some reservoirs, including Indian Valley, Stony Gorge, East Park, Beardsley, Tulloch, and Melones, were completely drained by the end of the 1976 water year. Table 2 shows reservoir storage at the end of the irrigation season, or October 1, 1976, compared to 1975 and the ten-year average. It shows, for example, that the Central Valley's reservoirs, with a total capacity of 27.0 million acre-feet (33,000 cubic hectometres) were drawn down to 9.8 million acre-feet (12,100 cubic hectometres) by October 1, 1976. This latter figure compares with the ten-year average storage in these reservoirs for that time of year of 17.0 million acre-feet (21,000 cubic hectometres). It is evident that Central Valley reservoirs alone began the 1977 water year with a 7.2 million acre-foot (8,900 cubic hectometres) deficit (compared with the average) or, put another way, their vacant storage was 175 percent of normal.

Figure 3 shows the October 1, 1976, reservoir storage in the State's seven major geographical areas compared to 1975 storage and the average for the ten-year period 1966-1975. Of the seven areas, only the South Coast had average storage levels. All areas had less stored water than in 1975. The most significant shortages show up in the figures for the Sacramento and

FIGURE 2

NATURAL RUNOFF, 1975-1976

WATER YEAR OCTOBER 1 – SEPTEMBER 30

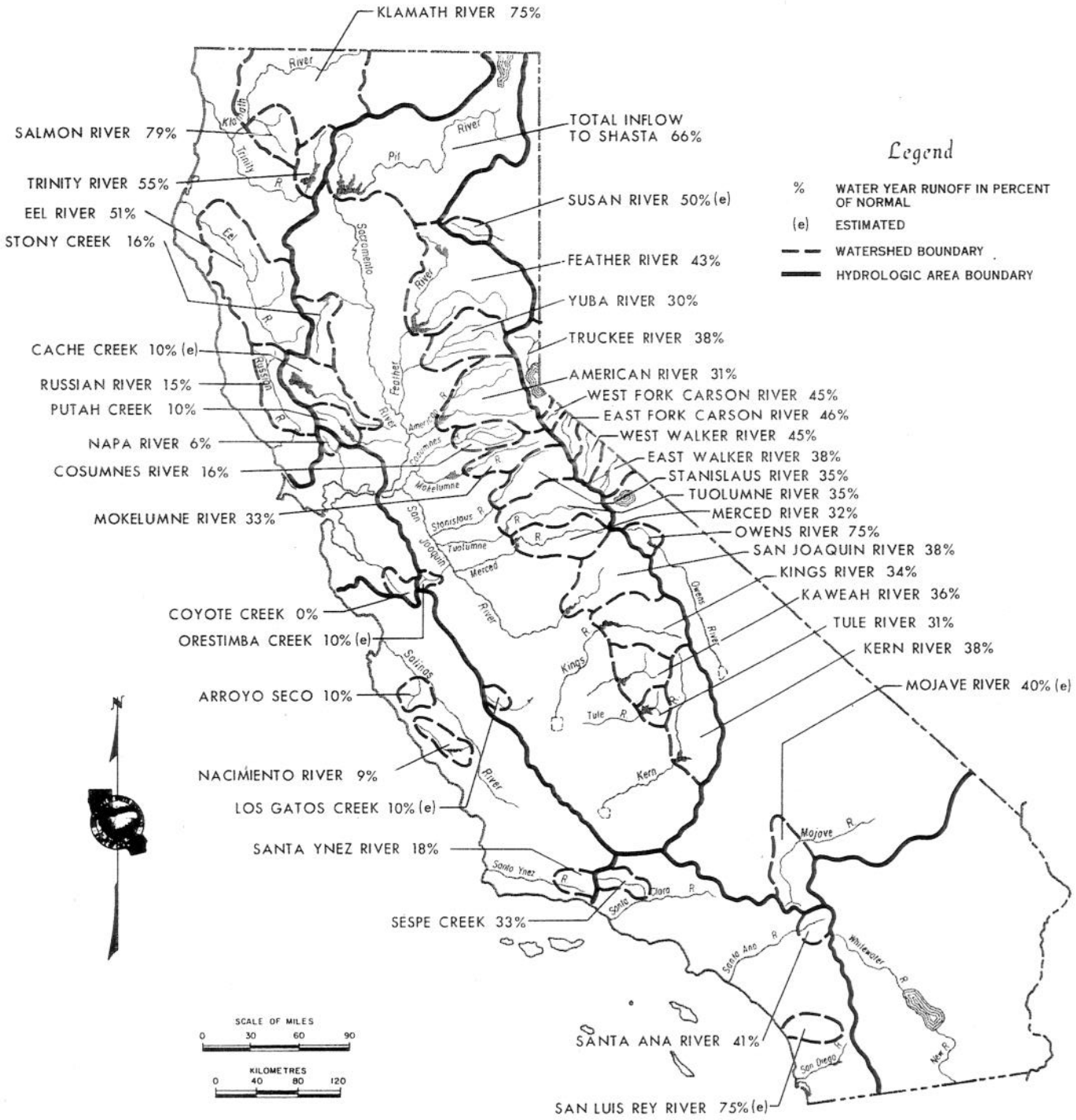


Table 1

1976 Water Year Flows for Selected Streams
(Unimpaired flows in 1,000 acre-feet)*
October 1, 1975 - September 30, 1976

Area, Stream, and Station	Median Flow	Minimum of Record		Observed Flow 1976	% of avg.
North Coastal Area					
Klamath, Copco to Orleans	4,295	1,772(31)**	(28)***	3,315	75
Salmon to Somesbar	1,180	473(31)	(28)	966	79
Trinity at Lewiston	1,085	266(24)	(12)	672	55
Eel at Scotia	4,720	878(24)	(17)	2,759	51
Russian at Healdsburg	771	306(72)	(41)	120	15
San Francisco Bay Area					
Napa near St. Helena	52	18(55)	(41)	4	6
Coyote Creek near Madrone	32	0(76)	(16)	0	0
Central Coastal Area					
Arroyo Seco near Soledad	89	11(76)	(06)	11	10
Nacimiento below Nacimiento Dam	141	15(31)	(16)	18	9
South Coastal Area					
Sespe Creek near Fillmore	38	3.5(51)	(16)	25	33
Arroyo Seco near Pasadena	3	0.5(51)	(11)	2	37
Santa Ana near Mentone	45	12(61)	(01)	23	41
Sacramento Valley Area					
Inflow to Shasta	5,073	2,479(24)	(22)	3,613	66
Sacramento above Bend Bridge	7,462	3,294(24)	(06)	4,845	61
Feather, Inflow to Oroville	3,952	1,295(24)	(06)	1,862	43
Yuba at Smartville	2,321	603(24)	(01)	690	30
American, Inflow to Folsom	2,594	543(24)	(01)	785	31
Cosumnes at Michigan Bar	331	40(24)	(08)	55	16
Mokelumne, Inflow to Pardee	727	190(24)	(01)	236	33
San Joaquin Valley Area					
Stanislaus, Inflow to Melones	1,117	261(24)	(01)	377	35
Tuolumne, Inflow to Don Pedro	1,832	546(24)	(01)	624	35
Merced, Inflow to Exchequer	919	252(24)	(01)	299	32
San Joaquin, Inflow to Millerton	1,679	444(24)	(01)	629	38
Kings, Inflow to Pine Flat	1,542	392(24)	(01)	536	34
Kaweah, Inflow to Terminus	352	102(24)	(01)	147	36
Tule, Inflow to Success	91	19(61)	(31)	42	31
Kern, Inflow to Isabella	528	175(61)	(30)	239	38
Lahontan Area					
Truckee, Tahoe to Farad	387	97(24)	(06)	146	38
West Carson at Woodfords	76	31(61)	(39)	32	45
East Carson near Gardnerville	238	76(24)	(23)	115	46
West Walker below Coleville	178	61(24)	(06)	80	45
East Walker near Bridgeport	98	24(24)	(23)	40	38
Owens below Long Valley Dam	147	73(31)	(08)	107	75
Colorado, Inflow to Lake Powell	11,545	3,767(34)	(06)	8,441	75

* 1,000 acre-feet equal 1.233 cubic hectometres.
( )** year of minimum flow (e.g. 24 = 1924)
( )*** year records began (e.g. 01 = 1901)

Table 2

RESERVOIR STORAGE BY HYDROGRAPHIC AREA*
THOUSANDS OF ACRE-FEET
(CUBIC HECTOMETRES)

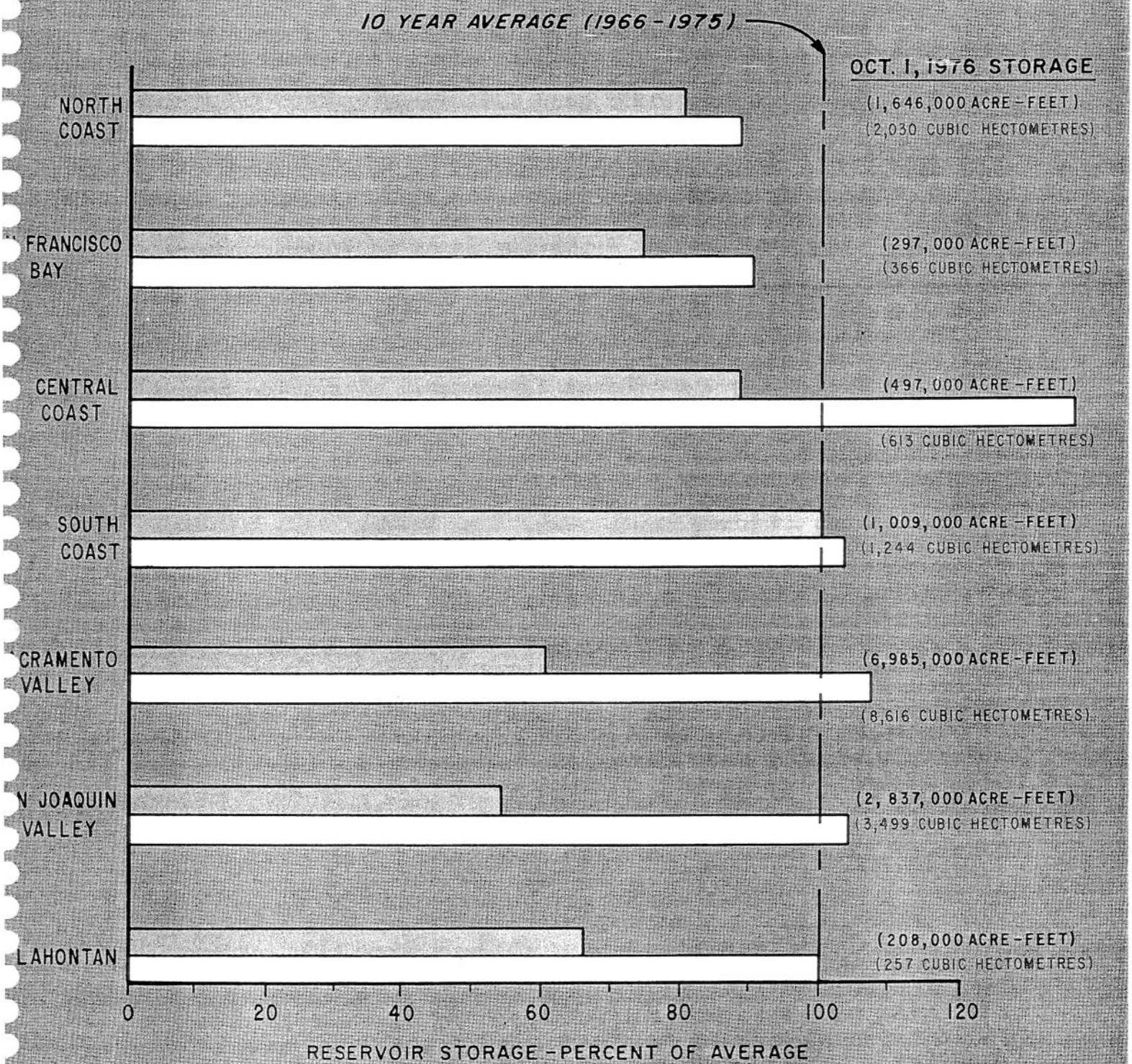
AREA	NUMBER OF RESERVIORS	TOTAL CAPACITY	10-YEAR AVERAGE 1966-75	STORAGE OCTOBER 1 1975	STORAGE OCTOBER 1 1976	PERCENT OF AVERAGE
INTRASTATE:						
North Coastal	8	2,938 (3 624)	2,157 (2 661)	2,328 (2 850)	1,747 (2 155)	81
San Francisco Bay	18	696 (859)	404 (498)	448 (553)	299 (369)	74
Central Coastal	9	1,049 (1 294	619 (764)	832 (1 026)	539 (665)	87
South Coastal	31	2,297 (2 833)	1,073 (1 324)	1,085 (1 340)	1,057 (1 304)	99
Sacramento Valley	48	17,166 (21 174)	11,731 (14 470)	12,646 (15 600)	6,985 (8 616)	60
San Joaquin Valley	31	9,815 (12 107)	5,285 (6 519)	5,495 (6 780)	2,837 (3 499)	54
Lahontan	8	426 (525)	313 (386)	313 (386)	208 (257)	66
Subtotal	153	34,387 (42 416)	21,582 (26 621)	23,147 (28 600)	13,672 (16 864)	63
INTERSTATE:						
North Coastal	3	1,205 (1 486)	569 (702)	738 (912)	635 (783)	112
Lahontan	5	1,085 (1 338)	738 (910)	795 (981)	400 (493)	54
Colorado Desert (1)	4	53,533 (66 033)	31,859 (39 298)	42,310 (52 200)	42,005 (51 813)	132
Subtotal (1)	12	55,823 (68 858)	33,166 (40 910)	43,843 (54 200)	43,040 (53 090)	130
TOTAL (1)	165	90,210 (111,274)	54,748 (67,531)	66,990 (82,632)	56,712 (69,954)	104

(1) Includes data for Lake Mead and Lake Powell which regulate flow of the Lower Colorado River, the major source of water for the Colorado Desert and South Coastal areas.

* The reservoirs used in this tabulation represent most, but not all, of the storage capacity available in each area.

FIGURE 3

RESERVOIR STORAGE IN PERCENT OF 10 YEAR AVERAGE



San Joaquin Valleys, where deficiencies (from the average) were 4.7 million acre-feet and 2.4 million acre-feet, respectively (5,800 and 3,000 cubic hectometres). Reservoir storage in Central Valley reservoirs on October 1, 1976, amounted to only 58 percent of normal.

The fact that storage at the beginning of the 1977 water year was so low, compared to the 1976 water year, means that a recurrence of 1976 conditions, or worse, will have extremely serious implications for 1977, and 1978 as well.

Ground Water Levels

The May report described a generally declining water table throughout the State. In the northern Sacramento Valley, average ground water levels in the spring of 1976 were reported to be 6 feet (2 metres) lower than in the spring of 1975, based on measurements made at 56 wells in the area. Levels continued to decline during the summer until August, when average additional decline reached 15 feet (5 metres) and pumping was reduced because of precipitation during the month. In the period August to October 1976, levels rose 6 feet (2 metres). Thus, the net decline during the summer was 9 feet (3 metres). In the lower Sacramento Valley, ground water levels generally reached all time lows in areas where wells are the major source for water. In the Wheatland-Olivehurst area in Yuba County, the southern and eastern parts of Sacramento County, and in the eastern part of San Joaquin County, levels of ground water were 3 to 10 feet (1 to 3 metres) lower than last year. The level also declined, between 10 and 20 feet (3 and 6 metres), in some parts of Yolo County. Elsewhere in Northern California, ground water levels are considered normal.

In the San Joaquin Valley, effects of increased pumping and decreased surface flows this summer are shown by the lowering of ground water levels for the period fall 1975 to fall 1976. The average lowering for the east side (based on data for 16 districts and areas covering the east side of the Valley south of the Chowchilla River, except for the Kern River service area) was 8.3 feet (2.5 metres). Values ranged from a decrease of 0.4 feet (0.1 metres) in the Porterville Irrigation District, to a decrease of 14.2 feet (4.3 metres) in the Alta Irrigation District. These same 16 districts and areas registered an average drop of 3.7 feet (1.1 metres) for the period spring 1975 to spring 1976. These values may be compared with the average annual lowering of 1.2 feet (0.4 metres) experienced during the previous five-year period, spring 1970 to spring 1975. These reductions, while greater than usual, are expected since in this Federal Central Valley Project service area conjunctive use of surface and ground water is practiced routinely; surplus water is stored underground in wet years and extracted in years of insufficient surface supply.

Ground water levels for the period fall 1975 to fall 1976 along the west side of the San Joaquin Valley (the Mendota-Huron area, Delta-Mendota area, and Wheeler Ridge-Maricopa area) continued to rise or hold stable. These areas, serviced by state and federal project water from the California Aqueduct and Delta-Mendota Canal, rely very little on ground water pumping.

Many wells have been abandoned and/or destroyed in the Mendota-Huron area (Westlands Water District) over the past eight years. Those facilities remaining have very little effect on the water levels which have risen from 50 to 220 feet (15 to 68 metres) over the past eight years.

Water levels in the Wheeler Ridge-Maricopa area showed rises ranging from 3.0 to 20.0 feet (1 to 6 metres). In the Delta-Mendota area, water levels remained about the same with an overall change of -0.4 foot (0.1 metre).

The Salinas Valley reported a ground water lowering of 5 to 7 feet (about 2 metres) in 1976. Northern Santa Clara County, which had shown a rise of 35 feet (11 metres) in ground water level during the previous five-year period, reflected an average decline of over 10 feet (3 metres) in 1976.

In the southern part of the State, major basins showed little effect of the drought. There were isolated instances of problems brought on by drops in ground water level in the foothills or coastal areas.

Stoppage of underground spring flows and drops in well levels were characteristic of coastal areas from Santa Barbara County to Mendocino County and in the foothills bordering the Central Valley.

1976 DRY YEAR IMPACTS

California is blessed with natural water resources which ordinarily provide an ample quantity of water annually to meet its diverse needs. These resources include a huge underground water supply and a usually reliable surface runoff. Californians have learned to harness these resources by tapping ground water and constructing over 1,200 dams[1/] to store water for later use. In a normal year, about 37,000,000 acre-feet (46,000 cubic hectometres) of water is used in California, about 40 percent from ground water and 60 percent from surface water.

In dry 1976, when surface runoff was deficient, greater dependence was placed on ground water.

Statewide Summary

Communities dependent on small surface reservoirs, shallow ground water basins, or springs, were hit hard by the drought. By year's end, approximately 50 were listed as having problems.

Impact on agriculture was serious. The California Department of Food and Agriculture estimates 1976 drought losses to agriculture to be $510 million. Dry-farm grain and non-irrigated rangeland suffered disastrously. Twenty-nine counties were declared disaster areas as a result of drought losses to the livestock and dry-farm grain portions of the industry.

Irrigated agriculture also suffered, although most areas served by large reservoir and conveyance systems or overlying major ground water basins fared reasonably well in 1976.

Fish and wildlife have been adversely affected with many species suffering reproductive losses because of the disturbance of their natural environment. Other losses were more direct as 1976's scarcity of water, forage, and cover took its toll.

Lack of snow greatly reduced skiing and other winter sports, with significant financial losses to those dependent on this industry. Recreation use of many lakes and reservoirs was reduced because of drawdown below boat ramps and improved beaches. Recreation was curtailed at some campgrounds due to fire hazards, and because water was not available for drinking or sanitation. Whitewater activities were hampered due to reduced streamflow and because power companies had less water to release. Most categories of water-related and mountain recreation in Central and Northern California reported lower than normal usage even when facilities were available. It is believed that this was due, at least in part, to the negative publicity attached to those facilities

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1/ Dams within the jurisdiction of the State of California and those owned or operated by the Federal Government.

heavily impacted, to the high fire danger at the start of the year, and to the threat of bubonic plague.

The low moisture resulting from the dry winter of 1975-76 led to one of the most difficult fire seasons during the months of June and July 1976 in the 12,000,000 acres (4,800,000 hectares) of brushland protected by the California Division of Forestry. Fortunately, the months of August and September 1976 were cooler and wetter than normal so late season fire conditions were not as severe, and a season that could have been extremely serious developed into one of moderate scale.

Hydroelectric power production was significantly reduced. By early fall of 1976, many power generation facilities were inoperable because their reservoirs were empty or were operating at low capability because of low storage. It is estimated that California hydropower energy production for 1976 was below normal (32.6 billion Kwh) by 12.6 billion kilowatt hours (Kwh), equivalent to 20 million barrels of oil. This was made up from purchases elsewhere, but the cost to Californians is tremendous. The Public Utilities Commission recently granted a rate hike for one Northern California utility which will amount to an increased cost to consumers of $144 million due to drought.

State Water Project

In 1976, the third driest year of the century, and the driest since the project began operation in 1962, the State Water Project (SWP), operated by the Department of Water Resources, performed reasonably well. It met all its firm water supply commitments, delivered some surplus water, offered water-related recreation, generated power and, in cooperation with the federal Central Valley Project (CVP), maintained water quality in the Delta.

The SWP deliveries of over 2.0 million acre-feet (2,600 cubic hectometres) of water this past water year (October 1975 through September 1976), largest in its history, exceeded by nearly 15 percent the previous high of 1.77 million acre-feet (2,180 cubic hectometres) registered in 1974-75. Deliveries from project reservoirs were planned to be as large as possible while still retaining sufficient carryover storage to meet entitlement deliveries and maintain Delta water quality if 1977 would also be as dry as 1934. Early in 1976, the Department suggested that the agricultural water users should consider carrying over to 1977 a portion of the water projected to be available in the surplus water category. The involved contractors decided against such an action. Consequently, surplus deliveries during water year 1976 totaled 626,407 acre-feet (772 cubic hectometres).

The drought took its toll, however. By October 1, 1976, Oroville Reservoir storage was down to 1,828,000 acre-feet (2,250 cubic hectometres), 52 percent of its 3,538,000 acre-foot (4,360 cubic hectometres) capacity. Storage continued to decline and by February 1, 1977, was about 1,607,000 acre-feet (1,980 cubic hectometres) and still declining. This compares with average storage for that date, for the ten-year period 1967-76, of 2,387,000 acre-feet (2,940 cubic hectometres).

Central Valley Project

The U. S. Bureau of Reclamation, operator of the Central Valley Project (CVP), met all power commitments, provided water for recreational activities, and delivered over 6,000,000 acre-feet (7,380 cubic hectometres) of water to its users during 1976. Another 800,000 acre-feet (990 cubic hectometres) was released to help maintain Delta water quality. A normal supply was provided to all customers except those dependent on Millerton Reservoir on the San Joaquin River, where only about 75 percent of Class I (firm contract) water was delivered.

Storage in CVP's major reservoirs at the conclusion of the season was 3.9 million acre-feet (4,800 cubic hectometres), down considerably from the 6.2 million acre-feet (7,600 cubic hectometres) normally contained at that time of year.

State-Federal Delta Operations

The driest year since the CVP and SWP began operations, and since present Delta water quality criteria were established, created quite a strain on the federal and state projects whose operational objectives must be closely coordinated for protection of the Delta. Many problems were encountered.[1/] Among them:

(1) As a part of the coordinated operation of the two projects, water must be released from storage to maintain water quality in the Sacramento-San Joaquin Delta. The State Department of Water Resources is required by law to meet the water quality objectives established in Basin Plans 2 and 5b adopted by the State Water Resources Control Board. The Bureau of Reclamation's position is that it is not legally obligated to meet these standards. However, the Bureau this year did make releases meeting its share of a 4,000 cfs (113 cubic metres/second) Delta outflow, a level of flow generally necessary to meet the standards during most, but not all, of the year.

(2) Basin Plan criteria for protection of striped bass spawning requires the maintenance of electrical conductivity (EC)

1/ For details of State Water Project Delta operations in 1976, see Bulletin 132-77, Appendix E (to be released later this year).

of less than 1,500 micromhos (approximately 1,000 mg/l TDS), 14-day average, for a five-week period after water temperature in the San Joaquin River reaches 60°F (16°C) at Antioch. On March 28 that temperature was reached, and about the same time electrical conductivity exceeded the standard. Immediately the SWP, but not the CVP, curtailed exports and the SWP increased releases from Oroville Reservoir to increase Delta outflow and achieve the criterion. However, only a small portion of the increased inflow in the Sacramento River reached the San Joaquin River system through the Delta cross channel and Georgiana Slough. As a result, the increased releases proved very ineffective in flushing the river and an EC lower than 1,500 was not achieved until April 12 and the 14-day running average exceeded the standards until April 21.

(3) By interim agreement with the State Department of Fish and Game (DFG), the SWP has agreed to curtail exports from the Delta to the maximum degree practical during a five-week period each spring for the protection of striped bass. In 1976, the DFG requested that this period be covered in June rather than in April as in the past. To comply, beginning May 22, 1976, exports were cut to those necessary to meet South Bay and North San Joaquin Aqueduct demands. Near the end of June, it became necessary to make repairs to the North San Joaquin Aqueduct. Repair work extended the curtailment until August 15, 1976. Thus, SWP exports were restricted for a period of about 12 weeks, rather than the five weeks planned. Water delivery commitments during this period were met by releases from San Luis Reservoir, supplemented during the last five weeks of the period by water pumped through the federal CVP Tracy Pumping Plant.

(4) State Water Resources Control Board Water Rights Decision D 1379 is stayed by the court and, therefore, an earlier decision, D 1275 (as amended by D 1291) is applicable. The D 1275 criteria restrict the SWP from storing water in its upstream reservoirs or exporting the natural inflow to the Delta during the months of April through June whenever maximum surface zone salinity at Blind Point on the San Joaquin River exceeds 250 mg/l chloride. This criterion was exceeded on April 15 for one day and then was reached again on April 28. The chloride concentration remained in excess of the criterion for the remainder of the applicable period (April 1 through June 30). Efforts to meet this criterion prevented the capture of some water in Oroville and San Luis Reservoirs, water which could have been used later.

(5) The original criteria for the Basin 2 Plan called for a daily limit of 4,000 mg/l chloride at the western end of Chipps Island. On May 16, and June 8, 1976, this criterion was exceeded due to sudden changes in barometric pressure with consequent winds through the Carquinez Strait, bringing in extra water from the saline San Francisco Bay. The operators of the water

projects are unable to forecast or respond quickly enough to counter such rapid changes in meteorological conditions.

In June, the Chipps Island chloride standard was modified to provide for the quality to be maintained on a 14-day running average, measured at the O & A Ferry Slip on Chipps Island. This new criterion has not been exceeded.

(6) Inability to accurately forecast the Sacramento Valley in-basin use caused considerable concern during late spring and early summer this year. Sacramento Valley in-basin use is the net effect of the inflow and water use in the Sacramento Valley between the release points of Keswick, Oroville, and Nimbus Dams and the outflow point at Sacramento. Projections were inaccurate because soil moisture conditions and temperature differed considerably from the average. On Figure 4, the projected in-basin use is shown by dashed lines, whereas the actual in-basin use is shown by the solid line. As can be seen, there was a significant difference between the projected and actual use during April and May requiring increased releases from storage at federal and state projects. This difference was reversed in July and August, thus allowing completion of the year without reducing deliveries further.

The Department is presently concluding a study of Sacramento in-basin use, which, when completed in February, will lead to more accurate projections of in-basin use, allowing improved operational capability of the SWP.

(7) In a successful effort to conserve water in the Delta, and with the agreement of Delta water agencies, the Department installed a rock barrier on Sutter Slough, near Clarksburg. The barrier, completed on August 31, 1976, and removed by December 10, 1976, served to divert additional water into the central part of the Delta to improve its water quality and decrease the drain on project reservoirs. It is estimated that this action conserved between 50,000 and 100,000 acre-feet (60-120 cubic hectometres) of water.

(8) Delta and project operations during the fall and early winter remained complicated by the absence of normal precipitation. As a result of lack of runoff, outflows to the Delta were far below normal for that time of the year and both the DWR and the USBR committed an extremely large volume of outflow from their reservoirs to control saline intrusion. For a short time in the fall of 1976, after the bulk of irrigation use, the outflow index was reduced to 2,500 cfs,[1/] a flow index which is ordinarily satisfactory. This was maintained from September 10 to

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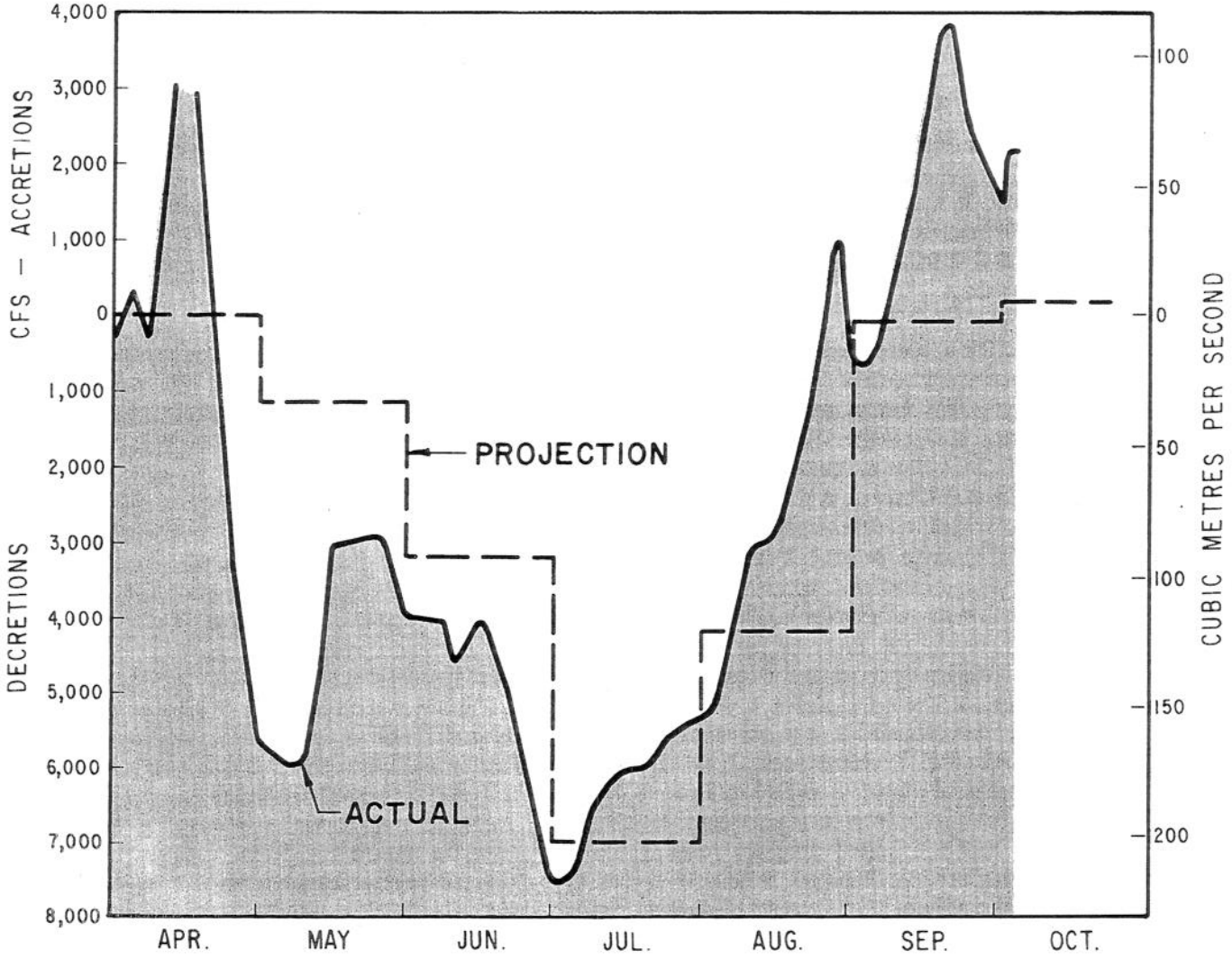
[1/] One cubic foot per second (cfs) equals 0.028317 cubic metres per second.

FIGURE 4

SACRAMENTO RIVER IN-BASIN USE

1976



November 10, 1976, when it was increased to 3,000 cfs.[1/] The index was increased again, in stages, to a maximum of 8,000 cfs[1/] by December 17, 1976. During December 1976 the index averaged 6,100 cfs[1/] and in January 1977, it averaged 4,700 cfs.[1/] During the first 10 days of February 1977, the outflow index averaged 4,700 cfs.[1/]

The additional water necessary to raise the index was not initially shared in by the USBR. However, because the CVP's Mendota Pool quality criteria were affected, the USBR agreed to modify CVP operation to share in an outflow of 5,000 cfs[1/] on December 3, 1976, and since then has been sharing fully in the outflow index.

The changes in index have been accomplished by modifying project operation to increase releases from SWP and CVP storage reservoirs, and to substantially reduce export pumping from the Delta. From October 15, 1976, to January 1, 1977, the SWP had withdrawn 219,000 acre-feet (270 cubic hectometres) from its storage facilities at Oroville, DWR's southern reservoirs, and San Luis. This occurred during what we might ordinarily expect to be a filling period for those facilities. As a consequence, by January 1, 1977, Oroville storage was only 50,000 acre-feet (60 cubic hectometres) above minimum contractual power pool.

Water quality conditions in the Delta were very close to the Basin Plan limits as a result of the increased volumes of flow made available by the modifications of SWP and CVP operations outlined above. However, the 14-day mean salinity at Chipps Island exceeded the Basin Plan limit of 4,000 mg/l chlorides from November 10, 1976, to January 13, 1977, when compliance was again achieved. At Blind Point, the 14-day mean electrical conductivity (EC) exceeded the Basin Plan limit of 3,100 micromohos EC (based on a non-"critical" year) from November 9, 1976, through December 31, 1976 (the end of the period for which the limit applies). As of February 9, 1977, the value was estimated to be 3,700 EC, but no standard will apply again until April. At Emmaton, the 14-day mean salinity standard of 1,000 mg/l chlorides (based on a non-"critical" year) in the Basin Plan was exceeded from December 8, 1976, until January 7, 1977. As of February 9, 1977, the value was estimated to be 1,087 mg/l.

The Department learned a great deal in 1976 about the water releases needed in a dry year to maintain water quality in the Delta, knowledge which will prove useful in 1977. The Board's February 8, 1977, adoption of interim water quality standards for 1977 provides a workable framework within which the SWP may be operated in 1977.

[1/] One cubic foot per second (cfs) equals 0.028317 cubic metres per second.

Dry-Farmed Agriculture

California's 22,000,000 acres (8,900,000 hectares) of dry-farmed grain and rangeland suffered extensive losses which in turn affected livestock producers. The California Crop and Livestock Reporting Service estimated that as of December 31, 1976, losses to this segment of California agriculture resulting from drought last winter and spring aggregated about $490 million. This was the major fraction of the total agricultural losses sustained, $510 million. Of the dry farm losses, $467 million was sustained by livestock producers on 20,000,000 acres (8,100,000 hectares) of rangeland and $23 million by small grain farmers on 2,000,000 acres (800,000 hectares).

The 29 counties declared disaster areas indicated that 13,828 farmers were affected by the drought, mostly in the livestock and dry-farm grain sectors. By November 30, 1976, 63 applications for relief had been received and 13 assistance loans had been processed by the Farmers Home Administration.

Details of the drought damage assessment are contained in the Department of Food and Agriculture's report, "Drought Damage to California Agriculture As of December 31, 1976", and only a few major points are repeated here.

The Bureau of Land Management reported that, out of its 862 permitted livestock users, 15 applied for grazing fee relief due to drought.

For many other livestock producers, the only options available were (1) to buy high-priced feed, or (2) sell early at light weights. Most chose the latter, driving market prices down.

Irrigated Agriculture

Because of 1975's above average storage carryover in reservoirs serving most of the State's irrigated agriculture and availability of ground water in many areas, drought impact on this segment of California agriculture was less severe than that experienced by dry farms and rangeland. There were some instances, however, where lack of sufficient water supplies caused economic loss. The California Crop and Livestock Reporting Service estimated the State's drought losses to irrigated crops as of December 31, 1976, to be nearly $20 million, mostly to fruit and nut crops.

Of the federal and state service areas, only the Friant-Kern system was unable to deliver its firm contract entitlement supplies. In this area, where surface supplies were only about one-third of the average, only about 75 percent of Class I (firm contract) water was delivered. However, this project normally

operates on a conjunctive use basis and surplus water from prior years, stored in the ground water basins, was utilized as ground water supplies in 1976.

Several San Joaquin Valley districts, which normally receive surface water from the Kings River, received no entitlement water in 1976. However, these districts were able to make short irrigation runs using water held in storage from previous years. Ground water supplied the additional requirement.

In the northern San Joaquin Valley, several irrigation districts experienced difficulties as their Merced, Stanislaus, and Mokelumne River sources did not yield all needed water. All but one of the reservoirs on the Stanislaus River were drawn down to dead storage by the end of a shortened irrigation season. The Merced River was short of meeting the total demand of 740,000 acre-feet (910 cubic hectometres) for the Merced Irrigation District; however it was possible to make up the shortage by pumping 200,000 acre-feet (247 cubic hectometres) of ground water.

In the Sacramento Valley, agricultural users dependent on Clear Lake, Cache Creek, and Stony Creek obtained less water than needed. Clear Lake provided no outflow to Yolo County users and their newly constructed Indian Valley Reservoir was completely drained by midsummer. Orland farmers also saw their surface reservoirs exhausted by mid-season.

Agricultural users in Lassen County near Susanville experienced drastic shortages, as did dairymen in Marin and Sonoma Counties. Many dairymen in the two counties were forced to truck in water for their herds. Agriculturists in the southern Santa Clara Valley and in Owens Valley were also adversely affected.

To combat problems imposed by the drought, farmers resorted to a variety of tactics. The irrigation season began as early as January 1976 for many, and it has continued into January 1977 for others. During this time, double cropping was eliminated in many instances so that the summer crops could be planted and harvested earlier before water ran out. Some row-crop farmers resorted to irrigating alternate furrows to conserve water. Although yields were reduced, reductions were somewhat less than the decrease in water usage. Other farmers, faced with a difficult choice, opted to preserve permanent crops, such as orchards, in lieu of irrigating annual plantings. Some farmers chose to leave fields fallow; few crop plantings were actually abandoned. In other areas, the time between irrigations was stretched out. In some areas, crops using large amounts of water, such as rice, were replaced by crops using less water, such as corn.

In Marin County, the Board of Supervisors appropriated $40,000 to pay a part of the costs of trucking water to dairies. This was supplemented by a $10,000 private donation. Local cooperative creameries in both counties donated use of their trucks and union drivers gave freely of their services. Water was purchased from local utilities.

Considerable demand was placed on the ground water supply; new wells were drilled and others were repaired, renovated, or deepened. By one account, the added cost of electrical energy to agricultural consumers exceeded $25 million. Most of the added energy requirement was for pumping extra ground water and for the extra lift made necessary by the falling water table. The well drilling industry experienced a boom and backlogs of uncompleted work at times reached one to two months.

Urban Areas

Large metropolitan areas suffered little impact since their water sources have considerable carryover capacity. Nearly all communities impacted were small, being dependent on local surface supplies (streamflow or small reservoirs) or ground water from wells. Most were located in the central coastal regions or in the foothill areas of the Central Valley. Communities with drought problems are shown on Figure 5 and listed in Table 3. The problems generally experienced were declining streamflow, loss of flow from springs, lack of sufficient surface reservoir supplies, or failing wells. Several communities were affected by reservoir levels falling below intakes to their supply systems.

Temporary solutions included water conservation, diversions from other sources, buying additional supplies, hauling water, drilling new wells or deepening others, extending existing pipelines into lowered reservoirs, and rationing.

The State Office of Emergency Services provided temporary loans of equipment to a number of public agencies experiencing difficulty due to the dry year. Equipment, made available from federal stockpiles, included 8-inch (200 millimetres) diameter pipe, pumps, generators, water purifiers, and chlorinators and was provided to approximately 15 communities.

During 1976, the State Department of Health's task of monitoring domestic water quality was made more difficult because existing sources were strained and many new sources were required, some of doubtful quality. Early in the year, the Department prepared a list of potential problem areas to aid it in planning. This proved useful in determining help needed. The more usual activities included monitoring quality and advising agencies of corrective action required. An unusual example of help provided was its operation to truck in water to the Pomo Indian community at Kelseyville, hit hard by lack of suitable water.

FIGURE 5

COMMUNITIES IMPACTED BY 1976 DROUGHT

Table 3

1976 DROUGHT AREAS - URBAN

County	Community	Service* Type	Problem Description	Solution	
				Temporary	Permanent
Amador	Pine Acres	P.D.	Just able to keep ahead of demand.	OES equip. loan	
	Pioneer	P.D.	Antelope Reservoir became low.	Use of private well & OES equipment.	
	Plymouth	P.D.	Dwindling flow from Cosumnes & Tributaries.	Drilled 2 wells & borrowed OES equipment.	
Butte	Cohasset	Ind.	Maple Creek dried up July 1.	Hauling water to tank.	
	Magalia	P.D.	Wells & mine shaft supplies dwindled.	Buying from PG&E conserving.	Davis-Grunsky Loan to finance enlarged system.
	Paradise	P.D.	Lowered reservoir levels due to repairs.	Bought from PG&E, conserved, rationed.	Enlargement of Magalia dam.
Calaveras	Copperopolis	P.D.	Reservoir nearly dried.	Conservation, temporary sources explored.	
El Dorado	Shingle Springs	P.D.			
	Cameron Park	P.D.	Transmission facilities inadequate.	OES equip. loan.	
	Pleasant Valley	P.D.			
	Diamond Springs	P.D.			
	El Dorado	P.D.			
Glenn	Elk Creek	P.D.	Stony Grove Reservoir water quality worsened.	OES filter equipment loan.	
Kern	Bodfish	W.C.	Well went dry.	Leased private well.	
	So. Bakersfield	W.C.	Shortage of Kern River Water.	Proposed rationing.	
Lake	Kelseyville	P.D.	3 wells extremely low, 1 pumped sand.	Restricted watering enforced.	Kelsey Creek Dam.
Los Angeles	Littlerock	P.D.	Littlerock Res. - low water level.	More wells.	Wells & California Aqueduct.
	Lake Elizabeth	W.C.	Well supply dwindled.	California Aqueduct.	
	Leona Valley	W.C.	Well supply dwindled.	Rationed; restricted flow on new connection.	SWP hookup July 1977
	Avalon	W.C.	Well supply dwindled.	Conserved, salt water flushing & fire protection.	Reclamation of sewage effluent.
Marin	Inverness	W.C.		Voluntary conservation.	

Table 3 (Continued)

1976 DROUGHT AREAS - URBAN

County	Community	Service* Type	Problem Description	Solution	
				Temporary	Permanent
	Bolinas	P.D.	Arroyo Hondo only a trickle.	Pumped from Pine Gulch Creek.	
Mariposa	Mariposa	P.D.	Stockton Creek low. 3 wells inadequate.	Restricted water use	New wells being constructed.
	Point Reyes				
	Stinson Beach			New well by DOW.	
	San Rafael	P.D.			
Mono	Twin Lakes	W.C.		Restricted watering.	
	Mammoth Lakes	P.D.		OES equip. loan.	
Monterey	Carmel Seaside Pacific Grove Monterey City of Sand Del Rey Oaks	W.C.	Shortage in regulating res. and too small pipeline.	PUC ordered rationing.	Install larger pipeline and construct treatment plant to remove iron and manganese.
	Marina	P.D.			
Napa	Baur Tract-Napa	W.C.		Rationed.	
Placer	Foresthill	P.D.	Reservoir storage became low.	Transferred water w/OES. New well. Shirt-tail Crk. pipeline (1978).	USBR dam (Sugar Pine) by 1980.
	Tahoe Park	W.C.	Spring supply very low.	Restricted watering & washing.	
	Roseville	P.D.	Folsom Reservoir level low.	Pumped from lake Folsom.	
Plumas	Crescent Mills	W.C.		Rationing 5-15-76.	
	Quincy	W.C.		Restricted watering & washing. New well.	2nd new well.
San Bernardino	Big Bear Lake Valley	W.C.	Wells & springs low in production.	2 new wells, vol. conservation, toilet kits, interconnection.	New well.
	Pinon Hills	W.C.	Shallow springs dried up.	Hauled, rationed.	Request for technical help.
San Luis Obispo	Morrow Bay	P.D.	Dropping well levels.	Vol. conservation; furnished water-saving kits.	Whale Rock water can be used in emergencies.
	Nipomo	W.C.	Dropping well levels.	Possible FmHA loan.	

Table 3 (Continued)

1976 DROUGHT AREAS - URBAN

County	Community	Service* Type	Problem Description	Solution	
				Temporary	Permanent
Santa Barbara	Mission Hills@ Lompoc	W.C.	2 of 3 wells went dry.	Rehabilitated wells.	
	Goleta	P.D.	Short supply.	Restricted watering. Water loan or purchase, USBR or Santa Barbara.	
Santa Cruz	Between Boulder Creek & Big Basin	W.C.	Springs diminished; Reservoir low.	Rationed.	New wells.
	Felton	P.D.	Supply short.	Rationed.	New wells.
	Scott's Valley	P.D.	Surface supply & wells ran short.	Restricted usage.	
	Santa Cruz	W.C.			
Shasta	Mountain Gate	P.D.	Shasta Lake level dropped below intake.	OES equip. loan to extend intake, conservation.	Improve intake facilities.
	Sugarloaf Mountain	Ind.	Insufficient spring flow.	Connected to private wells.	None.
	Castalla	W.C.			
Sonoma	Cotati	P.D.			
	Salmon Creek	P.D.			
	Jenner	P.D.			
	Petaluma	P.D.		Restricted watering.	
	Santa Rosa	P.D.		Used wells normally unused.	
	Preston	W.C.		OES equip. loan to transport water from another well.	
Tulare	Doyle Colony @ Porterville	P.D.	Well dry.	OES equip. loan to transport water from another well.	
Yolo	Yolo	Wells dried.		Deepened wells.	

*P.D. = Public Districts
Ind. = Individual
W.C. = Water Company

A Drought Center was established by the Department of Water Resources to collect information on drought problems and to bring needs and resources together to alleviate their impacts. Numerous state and federal agencies participated in providing resources, including the State Departments of Food and Agriculture, Fish and Game, Parks and Recreation, Navigation and Ocean Development, Health, Forestry, the Office of Emergency Services, Water Resources Control Board, University of California, Public Utilities Commission, and the Federal Bureau of Reclamation, Bureau of Land Management, Farmers Home Administration, Agricultural Stabilization and Conservation Service, Army Corps of Engineers, and Forest Service.

The Department sponsored legislation (AB 3793, Keene) amending the Davis-Grunsky law to aid drought-stricken communities by providing for low-cost loans up to $100,000 to public agencies serving communities of less than 100,000 population. These 2-1/2 percent loans will remain available in 1977. Five communities have already applied for assistance under this program.

In early July, in an historic first, the PUC ordered a private company serving the six Monterey peninsula communities to ration water according to a staged plan.

A DWR sponsored "Urban Water Conservation Conference" was held early in the year (January 16-17, 1976) and its "Agricultural Water Conservation Conference" followed on June 23-24, 1976.

The Department of Water Resources released its Bulletin No. 198, "Water Conservation in California", in May 1976. The bulletin identifies a number of water-saving ideas and practices as well as recommends specific actions. It was made available to all water agencies in the State.

A large number of communities encouraged voluntary water conservation, and a smaller number employed some form of mandatory conservation. Table 4 lists some of those practicing mandated conservation this year. A variety of conservation methods were employed to stretch out available supplies. These ranged from educational campaigns urging voluntary conservation to bans on certain usages, service shutoffs, and moratoriums on new connections. Included were such strategies as changes to plumbing codes to require low usage fixtures in new construction, retrofit kits for toilet and bathroom fixtures, water rate surcharges, metering, recycling waste water, and warnings and fines for violators.

Effectiveness of the conservation programs was measured by utility estimates of water saved. Participating communities reported water savings generally above 10 percent, commonly at least 20 percent, and at times ranging to over 50 percent. Effectiveness depended on the user's motivation. Those communities

TABLE 4: CONSERVATION METHODS
PRACTICED IN DROUGHT YEAR 1976

Community	Conservation Education	Plumbing Code Changes	Retrofit Kits Provided	Water Rate Surcharge	Metering	Recycled Water Use	Restricted Outside Use	Warnings and Citations	Service Shutoffs	Prohibition on new Connections	Other
Antelope Valley							X				
Avalon-Cat. Is.	X		X								
Ben Lomond	X						X	X			
Big Basin Area							X				
Big Bear Lake Vill.	X		X								
Bolinas										X	
Boulder Creek	X						X	X			
Calistoga	X		X	X			X				
Cambria							X				
Carmel	X		X				X			X	
Chico	X										
Chowchilla							X				
Cohasset	X										
Colusa Area	X										
Corte Madera	X		X				X				
Cotati	X						X				
Crescent Mills							X				
Davis							X	X			
Del Rey Oaks	X		X				X			X	
East Bay Cities	X		X								
El Granada	X						X	X			
Felton	X						X	X		X	
Gilroy		X					X	X			
Goleta	X		X				X	X			
Half Moon Bay	X						X	X		X	
Kelseyville							X	X			
Leona Valley							X				
Magalia	X						X	X			
Miramar	X						X	X			
Montara										X	
Monterey	X		X				X			X	
Morro Bay	X		X								
Moss Beach										X	
Nipomo							X				
Oakley			X			X					X[1/]
Pacifica										X	
Pacific Grove	X		X				X			X	
Pajaro Valley							X				
Paradise	X						X	X	X		
Petaluma	X						X				
Pine Acres							X				
Pine Grove							X				
Pinon Hills							X				
Pioneer							X				

[1/] Treatment and reuse of waste water.

TABLE 4: CONSERVATION METHODS (Continued)
PRACTICED IN DROUGHT YEAR 1976

Community	Conservation Education	Plumbing Code Changes	Retrofit Kits Provided	Water Rate Surcharge	Metering	Recycled Water Use	Restricted Outside Use	Warnings and Citations	Service Shutoffs	Prohibition on new Connections	Other
Pleasant Hill	X					X					X[1/]
Plymouth							X				
Port Costa	X					X					X[1/]
Princeton	X						X	X			
Quincy Area	X						X	X			X[2/]
Roseville	X										
Sand City	X		X				X			X	
San Rafael			X	X					X		X[3/]
Santa Cruz	X						X				
Scotts Valley	X						X	X		X	
Seaside	X		X				X				
St. Helena			X								
Stinson Beach							X			X	
Tahoe City			X								
Tahoe Park							X	X			
Twain Harte	X							X			
Valley Center					X						

1/ Treatment and reuse of waste water.

2/ Only recycled water can be used for landscape.

3/ Water saving devices are required on all new construction.

with critical problems recognized them early and generally took immediate steps to meet the problems head-on with the more stringent measures. These were the communities who reported the larger savings. Predictably, those communities with less reason to conserve conserved less. The Department is still engaged in a study to determine the extent and effectiveness of the conservation program; results should be available early in the year.

A factor that was recognized is that when metered water consumption falls, the supply agency's income is reduced. Rate structures were often modified to make up for this.

Recreation

With isolated exceptions, the State's recreational industry in Central and Northern California reported much lower than normal patronage. The dismal scene began in November 1975 when snow did not materialize on the ski slopes, was accentuated in December and January 1976 by precipitation's continued absence, abated somewhat in February with long-awaited snow fall, but was reinforced by the dryness of March.

In the Sierra Nevada winter sports region dependent on natural snow, conditions during the 1975-76 winter were very poor. The season in this area generally starts in November with many people on the slopes for the Thanksgiving and Christmas Holidays. The first beneficial storm of the 1976 season, however, came in February but warm weather kept melting each following storm until a heavy storm fell in the first week of March. The snowpack in most cases lasted through April and in some areas through May 1976. One resort reported that its season ordinarily lasts through June with a Memorial Day crowd of three to four thousand people. On Memorial Day 1976, there were less than one hundred on the slopes, so it closed the following day.

Another adverse factor acting during the 1976 season was the relative warmth of the weather which hampered the effectiveness of snow machines at those resorts with such facilities. Resorts with equipment to move snow were able to extend the season by stockpiling and packing some slopes but this operation was costly.

Publicity also had an adverse effect upon these mountain resorts. Because of the lack of patronage, financial losses were substantial. Several resorts declared bankruptcy. Others closed early to conserve funds.

Southern California was an exception to the poor skiing year for California ski areas. One resort in the San Bernardino mountains reported weather cold enough to operate snow-making machines and so built up its snowpack at every opportunity. The resort started its season on November 22, 1975, and continued

into May 1976. The result was a record-breaking year. Apparently skiers from all over the State were using these facilities because of lack of snow elsewhere.

Lake and reservoir-oriented recreation usage also suffered, with many of those dependent on this industry reporting substantial losses in income. Some of this was attributed to negative publicity. The experiences at Shasta Lake, where drawdown was the greatest of record, serve as an illustration of reduced usage. The local motel association attributed losses of up to 10 percent in room occupancy to low lake water levels. Marine equipment sales and service were down substantially; one dealer reported gross sales decline of over 40 percent and a layoff of three of his five all year servicemen. This was in contrast to a nationwide increase in sales of 21 percent reported by the Boating Industry for the year ending in July 1976. The local resort association conducted a survey of 28 local resorts and associated businesses and reported trade down by 75 percent, with some businesses closing early. The Shasta-Trinity National Forest Division of the U. S. Forest Service (USFS) reported that use, measured in visitor days, of Shasta Lake's public facilities (i.e. campgrounds, picnic areas, boat launch facilities, and the water surface) showed a decrease of 76 percent from the previous year's figures. The USFS expects that this loss figure will also be reflected in total sales at private facilities under permit with them.

Recreational use at SWP facilities in 1976 showed little impact with total usage showing a slight increase over 1975. The CVP's Whiskeytown Reservoir, near Shasta, had more use than ever; but Clair Engle Lake, also near Shasta, suffered a 38 percent decline in usage.

At other locations, many boat launching ramps, marinas, and beaches were left behind by receding waters. At a number of Northern and Central California reservoirs, boat access was limited eventually to the smaller, hand-carried variety. At other reservoirs, usable launching facilities became extremely limited in number. Even in the large, usually stable lakes such as Tahoe and Clear Lakes, launching and docking facilities were affected by low water. Table 5 indicates the effect of reservoir levels upon boat ramps at selected locations.

Floating marinas were especially vulnerable; by mid-season some were closed and others had been moved a considerable distance. As lake levels dropped, marina operators responded in various ways to provide continuity of service. At Shasta Lake, the USFS designed and built portable launch facilities. A private operation there relocated its marina to another location on the lake, constructing several miles of road for access. Landing mats were employed at Pardee Reservoir to extend ramps. At other locations, temporary gravel ramps were constructed.

TABLE 5

RESERVOIR ELEVATIONS
DURING 1976 RECREATION SEASON

Reservoir	Capacity A/F[1/]	Owner or Operator	County	Stream	Reservoir Elevation, Feet[2/] Oper. Max.	Aug. 1 1976	Oct. 1 1976	Boat Ramp
Almanor, Lake	1,308,000	P.G.&E.	Plumas	N. Fork Feather River	4,490	4,472	4,467	4,478
Antelope	21,600	D.W.R.	Plumas	Indian Creek	5,002	4,995	Dry	4,987
Berryessa	1,600,000	U.S.B.R.	Napa	Putah Creek	440	413	408	400
Black Butte	160,000	U.S.C.E.	Tehama	Stony Creek	473	441	420	410
Boca	41,100	U.S.B.R.	Nevada	Little Truckee River	5,605	5,596	5,592	
Bradbury	204,900	U.S.B.R.	Santa Barbara	Santa Ynez River	750	729	728	
Buchanan	150,000	U.S.C.E.	Madera	Chowchilla River	588	442	442	
Bucks	103,000	P.G.&E.	Plumas	Bucks Creek	5,157	5,126	5,104	
Camanche	431,500	East Bay M.U.D.	San Joaquin	Mokelumne River	235	202	196	200
Camp Far West	103,000	So. Sutter Water Dist.	Placer	Bear River	300	237	186	175
Casitas	451,000	U.S.B.R.	Ventura	Coyote Creek	567	549	548	
Castaic	350,000	D.W.R.	L.A.	Castaic Creek	1,515	1,472	1,492	1,300
Clair Engle	2,448,000	U.S.B.R.	Trinity	Trinity River	2,370	2,330	2,303	2,295
Clear Lake (Imp.)	420,000	Yolo Co. F.C.W.C.D.	Lake	Cache Creek	1,326	1,319	1,318	1,316
Crowley (Long Valley)	183,465	City of L.A.	Mono	Owens River	6,782	6,759	6,743	6,757
Davis (Grizzly Valley)	83,000	D.W.R.	Plumas	Big Grizzly Cr.	5,775	5,769	5,768	--
Del Valle	77,100	D.W.R.	Alameda	Arroyo Valle	695	692	687	662

[1/] 1,000 Acre-feet (A/F) equal 1.233 cubic hectometres

[2/] one foot = 0.3048 metre

TABLE 5 (Continued)

RESERVOIR ELEVATIONS
DURING 1976 RECREATION SEASON

Reservoir	Capacity A/F[1]	Owner or Operator	County	Stream	Reservoir Elevation, Feet[2] Oper. Max.	Aug. 1 1976	Oct. 1 1976	Boat Ramp
Donner Lake	11,000	Sierra Pacific Power Co.	Nevada	Donner Creek	5,936		5,932	5,927
Don Pedro	2,030,000	Turlock & Modesto I.D.	Tuolumne	Tuolumne River	830	707	680	595
East Park	51,000	U.S.B.R.	Colusa	Little Stony Cr.	1,198	1,145	1,145	
Edison, Lake T.A.	125,000	So. Cal. Edison Co.	Fresno	Mono Creek	7,642	7,583	7,560	
Elsinore	(Variable)	S.D. Parks & Rec.	Riverside	Santa Ynez Riv. (Sink)	1,233	1,229	1,229	1,227
Englebright	70,000	Calif. Debris Comm.	Nevada	Yuba River	527	518	518	
Folsom	1,010,000	U.S.B.R.	Sacramento	American River	465	414	395	390
Frenchman	55,000	D.W.R.	Plumas	Little Last Chance Creek	5,588	5,555	5,551	5,569
French Meadows	133,700	Placer Co. W. Agcy.	Placer	M. Fk. American River	5,263	5,190	5,171	Extended
Hell Hole, Lower	208,400	Placer Co. W. Agcy.	Placer	Rubicon River	4,630	4,555	4,512	4,530
Hidden	90,000	U.S.C.E.	Madera	Fresno River	540	436	436	
Huntington Lake	88,834	So. Cal. Edison Co.	Fresno	Big Creek	6,950	6,949	6,947	
Ice House	45,960	S.M.U.D.	El Dorado	S.F. Silver Cr.	5,450	5,419	5,408	5,403
Indian Valley	300,000	Yolo Co. F.C.W.C.D.	Lake	Trib. Cache Cr.	1,485	1,335	1,308(Dry)	
Isabella	570,000	U.S.C.E.	Kern	Kern River	2,605	2,544	2,530	2,522

[1] 1,000 Acre-feet (A/F) equal 1.233 cubic hectometres

[2] one foot = 0.3048 metre

TABLE 5 (Continued)

RESERVOIR ELEVATIONS
DURING 1976 RECREATION SEASON

Reservoir	Capacity A/F[1/]	Owner or Operator	County	Stream	Reservoir Elevation, Feet[2/] Oper. Max.	Aug. 1 1976	Oct. 1 1976	Boat Ramp
Jackson Creek	22,000	Jackson Vly. I.D.	Amador	Jackson Creek	468	421	418	410
Jackson Meadows	68,500	Nevada I.D.	Nevada	Middle Fk. Yuba River	6,036	5,989	5,923	6,010
Leroy Anderson	91,300	Santa Clara Co. F.C.W.D.	Santa Clara	Coyote River	625	575	565	
Little Grass Valley	93,010	Oroville-Wyandotte I.D.	Plumas	S. Fk. Feather River	5,047	5,023	5,010	5,020
Loon Lake	76,500	S.M.U.D.	El Dorado	Gerle Creek	6,410	6,376	6,362	6,360
Lopez	51,000	San Luis Ob. Co. F.C.W.C.D.	San Luis Obispo	Arroyo Grande Cr.	520	509	508	450
Lower Bear River	48,500	P.G.&E.	Amador	Bear River	5,816	5,793	5,762	
Mammoth Pool	123,000	So. Cal. Edison Co.	Fresno	San Joaquin Riv.	3,330	3,261	3,199	
McClure (New Exchequer)	1,026,000	Merced I.D.	Mariposa	Merced River	867	742	665	745
Melones	112,500	Oakdale S.S.J.I.D.	Calaveras	Stanislaus River	735	623	620(Dry)	618
Mendocino (Coyote Vly.)	122,500	U.S.C.E.	Mendocino	E. Fk. Russian River	765	723	712	720
Millerton (Friant)	520,500	U.S.B.R.	Fresno	San Joaquin River	578	510	502	465
Nacimiento	350,000	Montery Co. F.C.W.C.D.	San Luis Obispo	Nacimiento River	795	740	718	
New Bullards Bar	969,600	Yuba Co. Water Agency	Yuba	N. Yuba River	1,957	1,797	1,783	1,782
New Hogan	325,000	U.S.C.E.	Calaveras	Calaveras River	713	641	635	582

[1/] 1,000 Acre-feet (A/F) equal 1.233 cubic hectometres

[2/] one foot = 0.3048 metre

TABLE 5 (Continued)

RESERVOIR ELEVATIONS
DURING 1976 RECREATION SEASON

Reservoir	Capacity A/F[1]	Owner or Operator	County	Stream	Reservoir Elevation, Feet[2] Oper. Max.	Aug. 1 1976	Oct. 1 1976	Boat Ramp
Oroville	3,484,000	D.W.R.	Butte	Feather River	900	798	740	725
Pardee	210,000	East Bay M.U.D.	Amador	Mokelumne River	567	525	511	540
Perris	125,000	D.W.R.	Riverside	--	1,590	1,570	1,567	1,535
Pine Flat	1,000,000	U.S.C.E.	Fresno	Kings River	954	781	760	740
Pyramid	179,000	D.W.R.	Los Angeles	Piru Creek	2,579	2,571	2,576	2,553
Rollins	66,000	Nevada I.D.	Nevada	Bear River	2,171	2,095	2,073	2,140
Ruth (R. W. Mathews)	51,800	Humboldt Bay M.W.D.	Trinity	Mad River	2,656	2,647	2,638	
Salt Springs	139,400	P.G.&E.	Amador	N. Fk. Mokelumne River	3,959	3,817	3,799	3,927
San Antonio	348,000	Monterey Co. F.C.W.C.D.	Monterey	San Antonio Riv.	771	761	717	
San Luis	2,040,500	U.S.B.R.	Merced	San Luis Creek	543	395	428	326
Scott (Lake Pillsbury)	93,724	P.G.&E.	Lake	Eel River	1,827	1,903	1,892	
Scotts Flat	49,000	Nevada I.D.	Nevada	Deer Creek	3,075	3,038	3,016	3,030
Shasta	4,500,000	U.S.B.R.	Shasta	Sacramento Riv.	1,006	935	910	1,004*
Shastina (Dwinnel)	72,000	Montague W.C.D.	Siskiyou	Shasta River	2,805			
Shaver Lake	135,283	So. Cal. Edison Co.	Fresno	Stevenson Cr.	5,370	5,318	5,304	
Silverwood (Cedar Springs)	78,000	D.W.R.	San Bernardino	W. Fk. Mojave River	3,355	3,339	3,350	3,308

[1] 1,000 Acre-feet (A/F) equal 1.233 cubic hectometres

[2] one foot = 0.3048 metre

TABLE 5 (Continued)

RESERVOIR ELEVATIONS
DURING 1976 RECREATION SEASON

Reservoir	Capacity A/F[1]	Owner or Operator	County	Stream	Reservoir Elevation, Feet[2] Oper. Max.	Aug. 1 1976	Oct. 1 1976	Boat Ramp
Sly Creek	65,050	Oroville-Wyandotte I.D.	Butte	Lost Creek	3,531	3,451	3,419	
Sly Park	41,033	U.S.B.R.	El Dorado	Sly Park Creek	3,471	3,415	3,408	
Spaulding	74,488	P.G.&E.	Nevada	S. Fk. Yuba Riv.	5,195	4,957	4,897	
Stampede	225,195	U.S.B.R.	Sierra	Little Truckee River	5,949	5,892	5,879	5,909
Stony Gorge	50,055	U.S.B.R.	Glenn	Stony Creek	841	789	789	
Success	82,000	U.S.C.E.	Tulare	Tule River	653	600	588	583
Tahoe, Lake	732,000	U.S.B.R.	Placer	Truckee River	6,228	6,226	6,225	6,223
Terminus	150,000	U.S.C.E.	Tulare	Kaweah	694	598	589	566
Tulloch	68,400	Oakdale S.J.I.D.	Calaveras	Stanislaus River	511	468	420(Dry)	
Twitchell	240,113	U.S.B.R.	Santa Barbara	Cuyama River	652	501	501	
Union Valley	271,000	S.M.U.D.	El Dorado	Silver Creek	4,870	4,772	4,702	4,790
Virginia Ranch (Merle Collins)	57,000	Browns Vly. I.D.	Yuba	Dry Creek	1,183	1,145	1,132	1,140
Whiskeytown	241,000	U.S.B.R.	Shasta	Clear Creek	1,220	1,209	1,209	O.K.

*Several floating ramps in use all year.

[1] 1,000 Acre-feet (A/F) equal 1.233 cubic hectometres

[2] one foot = 0.3048 metre

The financial loss to those dependent upon lake-oriented recreation was substantial and in those areas where such recreation forms a large portion of the total business product, the impact was staggering. As was the case with ski resorts, lake resort owners found few avenues of financial help.

The California Department of Parks and Recreation closed portions of several state parks and recreation areas because of fire danger or lack of water. Only one of its parks, the Henry J. Coe State Park in Santa Clara County, was totally closed due to extreme fire danger. Several state campgrounds were closed temporarily due to threat of bubonic plague, a disease considered by some experts to be spread more readily in years of drought.

High country use was apparently down this year as high Sierra pack train operators reported a substantial lessening of business. Whitewater enthusiasts found their choices limited. The Bureau of Land Management reported river floating use was down considerably because of low water, publicity indicating low water when indeed levels were high enough, and litigation by abutting landowners and a county board of supervisors. Days of visitor use this year on the Stanislaus River were 16,000 compared to 32,000 in 1975, and on the American River, 14,000 compared to 36,000 in 1975.

Fish and Wildlife

Much of the drought's effect on fish and other wildlife will be subtle, with the impact measured by each species' reaction to lessened food and water, and the harm to its natural environment. In many cases, the impact will not be calculable for several years because reproductive success is involved. Fortunately, fish and wildlife exhibit a great deal of resilience; most populations are withstanding the dry conditions and will quickly bounce back to normal population size with a return of favorable conditions.

The Department of Fish and Game (DFG) reports that the greatest obvious impact of the dry winter of 1975-76 was on the 1976 salmon spawning run, influenced to a large degree by flow releases from dams in the Central Valley.

When, in the spring of 1976, Central Valley water agencies reduced downstream releases to conserve water, the low flows undoubtedly affected juvenile king salmon outmigration. The effect of the low flows in 1976 will not be clear until the fish reach maturity, become vulnerable to the ocean fishery, and return to spawn in 1978 or later. However, there is an early indication of the effects of reduced flows. In the spring months of 1975, beach seining conducted in the lower Sacramento River and Delta netted a total of 1,310 juvenile king salmon, whereas in 1976, the same effort produced only 538 fish.

The dry year conditions also affected salmon in their adult stage during the 1976 fall spawning. Because of the low storage in the State's reservoirs, water releases were at temperatures well above maximum levels for successful salmon spawning and for incubation of eggs in the gravel. Planned fall reductions in water releases would have compounded the problem by dewatering spawning gravel during spawning times.

To improve the water temperature and flow situation, the U. S. Bureau of Reclamation (USBR) and State Department of Water Resources (DWR) cooperated in altering operations at Shasta, Trinity, Folsom, and Oroville reservoirs to provide the best available water temperatures and to stabilize flow releases during the spawning period. Water temperatures were reduced on the Sacramento River by utilizing cooler Trinity-Whiskeytown water with a corresponding decrease in releases from warmer Shasta Reservoir. This operation commenced on October 1 and by October 14, 1976, temperatures of 58°F (14°C) were achieved at Red Bluff. American River temperatures were lowered by using the Folsom Dam low level outlet near river elevation. This operation was at the expense of some power production.

Flow was stabilized on the Sacramento River through a mutual water exchange between the USBR and DWR. A stabilized spawning flow of 3,900 cfs (110 cubic metres/second) was maintained from October 1 to December 1, 1976, when it was reduced to 3,250 cfs (92 cubic metres/second). Even though a flow of 3,900 cfs (110 cubic metres/second) is the lowest spawning flow since Shasta Dam began operating, and thus less spawning gravel was available, these flow conditions are expected to affect salmon reproduction less than a fluctuating high to low flow condition.

In some instances, where there are no conservation facilities, opportunities to improve conditions simply do not exist and salmon and other fish will be at the mercy of the elements. This is particularly true along the Central and Northern Coasts.

A primary concern is the assurance of adequate streamflows through the winter and spring since spring flows are especially important to production of juvenile salmon. Because of current low reservoir storage, water agencies are anxious to capture all runoff possible in the event that 1978 is also dry. These agencies are aware of the problem facing the salmon resource and negotiations are underway to arrive at water management strategies that recognize the needs of all interests.

Much less is known about the environmental requirements of American shad, but preliminary observations by the DFG indicate that shad fared less well than in previous years. Juvenile shad

spawned in the spring are normally abundant in the lower Sacramento River in late summer and fall. In 1976, however, juvenile shad were scarce. For example, the number of downstream migrating young shad captured at the State Water Project's fish screens in August was less than one-tenth the density of August 1975.

The DFG reports that striped bass fishery resources in the Delta suffered substantial losses this year with the survival of young striped bass approximately equaling that of 1959 and 1972, the lowest on record. It was expected that survival of both striped bass and shad would be low since historical records show that survival of these species is low when flows are low and high when flows are high. Low 1976 survivals resulted despite releases of water by the USBR and DWR in amounts sufficient to meet normal year water quality standards of the Delta. Low striped bass survivals could result in poorer fishing three or four years from now, but current populations of adults are of a magnitude that good production of young can be expected whenever conditions return to normal.

The average abundance of Neomysis shrimp, the principal food of young striped bass, was about half that of the lowest abundance level previously measured, and this probably contributed to the low survival rate.

Trout populations at the higher elevations suffered the least, whereas those at the lower elevations (generally less than 5,000 feet or 1,500 metres) were adversely affected by drought as early as June 1976. The impact on inland fishes, amphibians, and reptiles was moderated to a certain extent by an unusually wet August and September. In particular, small trout streams destined to dry up by late summer 1976 benefitted from this unexpected moisture. The low precipitation experienced so far in 1977 has not erased the major detrimental features of the drought on trout. Some streams will have to be stocked with fingerlings to reestablish their trout populations. Reservoirs which were completely drained, such as Beardsley on the Stanislaus River, will have to be restocked.

The drought has had a serious impact on the DFG's catchable trout program which will only worsen as a result of another dry year. Many trout plantings scheduled for streams had to be canceled due to low water and high temperatures. Trout from the canceled plantings were stocked in larger rivers, lakes, and reservoirs. Fish habitat most affected by the drought was that found in Northern and Central California fluctuating reservoirs, particularly those waters at the lower elevation (Shasta, Don Pedro, Millerton, etc.). Rapidly declining water levels during the spring and summer disrupted spawning activities of warmwater fishes (largemouth bass, bluegill, crappie). Recent shoreline sampling at a number of important reservoirs revealed either a

complete loss or a major reduction of the 1976 largemouth bass year class. If a second consecutive drought year is experienced, future angling success will be significantly reduced. The DFG believes the best means of maintaining resident fish may be to stabilize reservoir water levels during the critical weeks beginning with the onset of spawning and ending when bass fry leave the nests.

Fortunately, a near normal water year in Southern California in 1976 protected the great reptile resources of that region. The lack of winter moisture in Northern California precluded normal reproduction of many amphibians, particularly the salamanders. However, they are long-lived animals and should be able to survive one or two years of drought. No serious difficulties are expected for the rare and endangered species of fishes, amphibians, and reptiles, even if 1977 continues dry. However, the populations will be carefully monitored to determine if there is need for action to ensure their continued existence.

Dry year effects on deer ranged from moderate to severe and varied throughout the State. In general, deer summer ranges suffered, especially at the middle altitudes. Competition with livestock in the mountains was heavy as ranchers grazed their stock over a longer period than usual because of forage shortages at lower elevations.

Conditions affecting deer were most severe in the central and northern inner coastal areas. The central and south coastal area situation was relieved by early fall rains. North inner coastal areas remained dry but deer were able to get by because of a fair to good acorn crop which provided a high energy source.

The northeastern area was also very dry but deer have gotten along well to date, probably because the milder winter allowed the animals to enter the summer of 1976 in good shape.

In Southern California and the desert areas, 1976 summer and fall precipitation was greater than normal and big game feed conditions are good.

The DFG does not believe that the 1976 drought produced severe stress on big game species; however, a lot depends on the winter of 1976-77. A second year of drought will result in considerable stress to the herds.

The inner coastal area had almost no reproduction of upland game birds in 1976 and bag limits of quail and chukar were reduced. The DFG noted that pheasant production was down significantly in the Delta and the western San Joaquin Valley. The remainder of the State, except for northeastern California, found chukar, quail, doves, and the upland game bird reproduction about normal, with the southeastern desert area above normal.

Water conditions in 1976 were not severe on the DFG's waterfowl management areas due to continued availability of surface and ground water. In some instances, surface water was in short supply resulting in increased reliance on pumping from ground water. To reduce incidence of botulism being experienced in the Butte Basin drainage area because of this past year's low water, the DWR diverted water from Oroville Reservoir into the area. It was delivered through PG&E's Western Canal to the Sutter Federal Wildlife Refuge. After passing through the area, the water was available for use downstream and in the Delta.

Some bald eagle foraging habitat was reduced by low water conditions. For example, McCoy Flat Reservoir in Lassen County dried up much earlier than usual in 1976 and attendant fish used by eagles were lost. Honey Lake, Lassen County, dried up resulting in a loss of water-oriented wildlife, especially fish-eating birds such as the white pelican. There has been a major reduction of salt marsh yellowthroat, which breeds only in salt marshes around San Francisco Bay, affected by low Delta outflows of 1976. An even greater reduction would be anticipated with a repeat of those conditions in 1977. Black rails that nest in the Olema Marsh, Marin County, had their areas severely reduced in 1976 due to inadequate precipitation.

A measure of the drought's effect on at least the bird population is the annual count made by interested groups. The Audubon Society reported that its annual count in the Sacramento area indicated considerably fewer individuals than in past years.

Energy

In 1976, California's hydroelectric facilities generated 20 billion Kwh, compared to 32.6 billion Kwh during a normal year. The reduction in hydroelectric generation (12.6 billion Kwh) was equivalent to about 20 million barrels of oil at a cost of $280,000,000. An additional loss of 4 billion Kwh was postponed because power utilities in many instances elected to continue using their reservoirs to generate power in 1976 from levels much lower than normal. As a result of this extra drawdown, reservoirs are at extremely low levels.

The economic impact of the reduced amount of hydroelectric generation in California was eased somewhat by the larger amounts of relatively cheap hydroelectric energy available from the Pacific Northwest and by greater use of natural gas by steam generating plants.

Because electrical energy was available from alternative sources, reduced hydroelectric generation in California during the year did not result in power shortages or blackouts.

Forests and Wildlands

The California Department of Forestry (CDF) reported that the incidence of fires began earlier than usual because of the dryness brought about by lack of precipitation. The most destructive fires (in terms of acreage burned) occurred in late June and early July. Of the total acreage burned in 1976, 85 percent did so by July 15 compared with the 12-year average of 25 percent.

Starting in the second half of the 1976 season there was a significant change in the weather. Air moisture and humidity were generally higher than normally expected. Fuel moisture, especially in dead fuels, rose considerably. As a result, there were only 8 fires of over 100 acres (40 hectares) reported in August and September 1976, by the CDF, compared to 37 fires of similar magnitude in June and July 1976.

WATER AVAILABILITY IN 1977

Water planning would be simplified if we could predict future events with some degree of certainty and confidence. Unfortunately, the techniques of long-range weather forecasting are still in the development stages, and we must admit that we do not know what the winds will bring.

We are not unlike the participant in a coin toss. Before the toss of two coins, the chance of both coming up tails is one in four. After the toss of the first, the chance of the second coming up tails is still 50 percent. We believe the same is true of weather; at the beginning of this winter (in the fall of 1976) the chance of its being dryer than normal was even. The extremely dry weather of the first five months (October through February) of the 1977 water year has changed those odds. With the passing of the months counted upon to produce the rainfall needed, our chances for adequate rainfall have been reduced to near zero.

The cause of the current problem, as it was in 1976, is the high-pressure ridge established in the atmosphere over the West Coast. Its persistence has been the dominant factor in the weather pattern affecting California this fall and winter. Figure 6 represents a typical condition experienced time and again during the period October-February. It shows the high-pressure ridge (denoted by upward projecting contours along the western coast of the U.S.) shunting storms well to the north of California.

In much of Northern California, precipitation has been less than one-quarter of that normally experienced by this time (mid-February). Unfortunately, this is in an area where most of California's surface reservoirs are located. Figure 7 shows accumulated precipitation from October 1, 1976 (beginning of the water year), to February 1, 1977, compared to the average for that same period at selected stations throughout the State. Based on that comparison, it is clear that the North Coastal, Central Valley, and Sierra regions are severely deficient. Some North Coastal locations which had adequate rainfall last year (e.g., Eureka and Crescent City) this year have joined the locations with extreme deficiencies in rainfall. By this time of the year (February 15), most stations would ordinarily have received about two-thirds of the rainfall normally expected for the period October 1976 to July 1977; but Crescent City presently has only 12 percent; Shasta 11 percent; and Sacramento 16 percent.

Comparison of Figure 7 with Figure 1 (page 2) shows that, for a large part of Northern California, precipitation this year is much less than that of 1976.

FIGURE 6

TYPICAL HIGH PRESSURE RIDGE NEAR WEST COAST IN WINTER 1976-1977

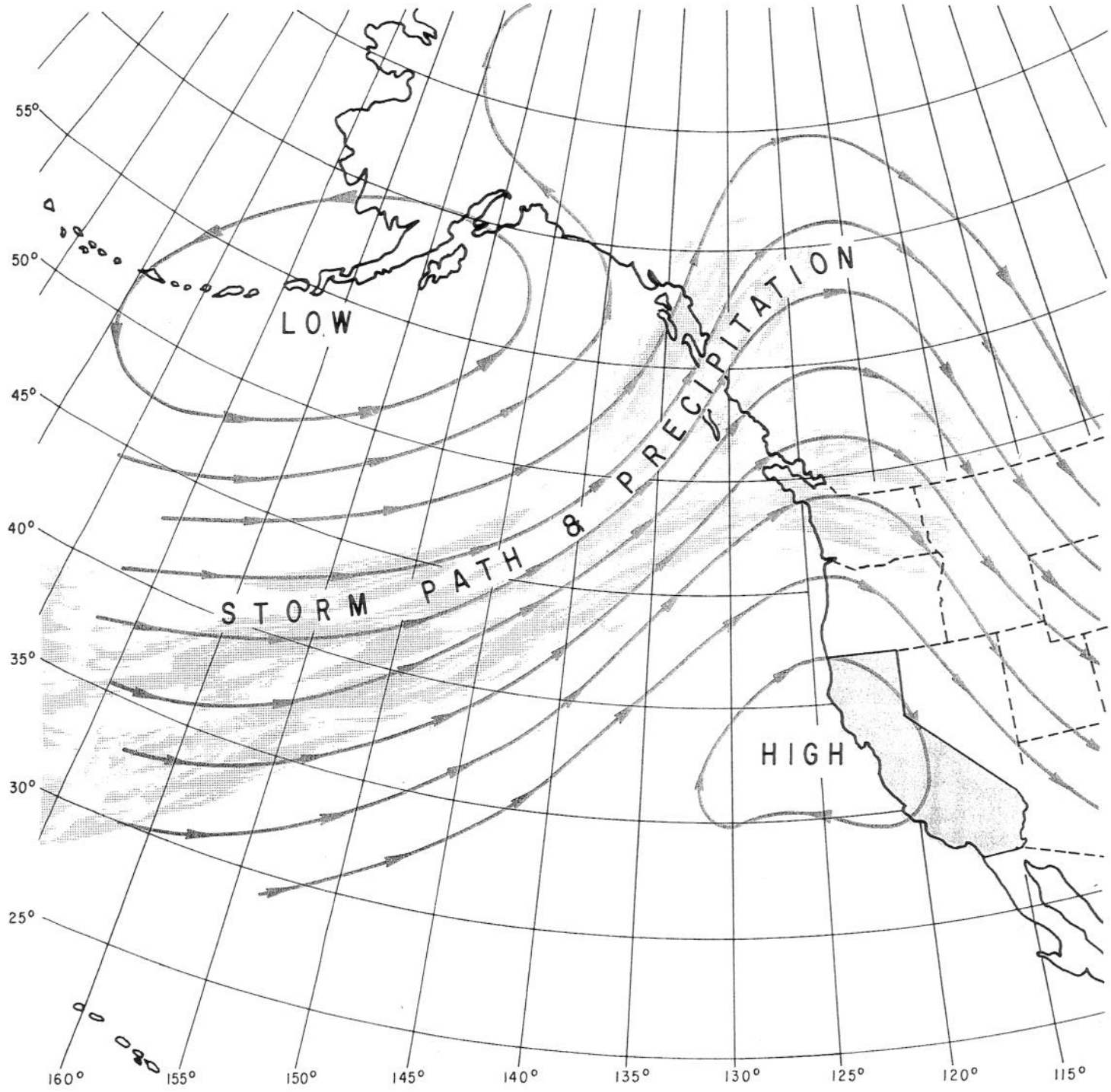


FIGURE 7

PRECIPITATION OCTOBER 1, 1976 TO JANUARY 31, 1977

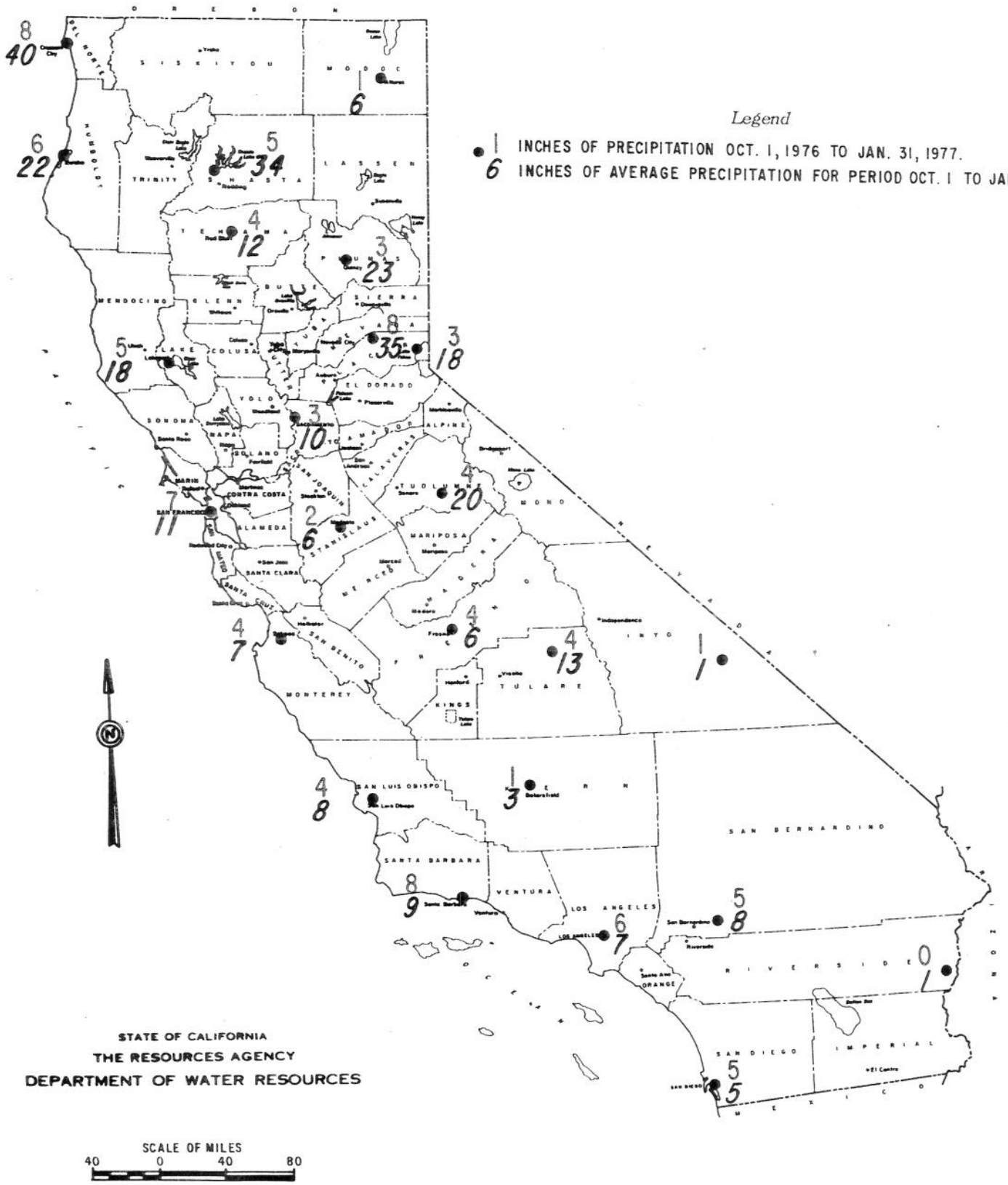


Figure 8 shows monthly precipitation at several locations for selected dry years (1923-24, 1933-34, 1975-76, and 1976-77 to date). The current year ranks among the driest for Northern California.

A large part of California is dependent for its runoff upon the precipitation falling in the form of snow at higher elevations in the Sierra. The snowpack generally begins in November and increases steadily through the winter months, reaching a maximum depth and water content about April 1. The California Cooperative Snow Surveys (a group composed of public agencies, private organizations, public utilities, municipalities, and state and federal agencies) reports that the February 1, 1977, snowpack measurements were among the lowest of record, with the layer of snow less than 2 feet (61 CM) in depth with less than 6 inches (150 millimetres) of water content. Runoff forecasts translate this thin mantle of snow into spring runoffs which may establish new record lows for snowmelt.

Snowpack is far below average. Only one storm during the months of October through January produced significant snowfall. As a result, the accumulated snowpack on February 1 was only 25 percent of average for this date. This equates to only 15 percent of the maximum seasonal accumulation which usually occurs by April 1. Normally, 65 percent of the winter's pack has been deposited by February 1.

The record lack of snowpack is demonstrated by the conditions at Norden, in the Sierra near Donner Summit. Figure 9 shows this year's pack compared to the average conditions and to those of 1923-24, previous recordholder for minimum snowpack.

Figure 10 shows accumulative monthly natural runoff to each of 4 major northern California reservoirs (Shasta, Folsom, Oroville, and Millerton) for selected dry years (1923-24, 1933-34, 1975-76, and 1976-77 to date). It is clear that the current year's flows rank among the lowest of record. There is a significant possibility that this year's flow may eclipse the previous dry year record held by 1924.

Figure 11 shows total unimpaired water-year flows for selected Central Valley streams for the same dry years. Also included is the average flow and flow to date.

The Department of Water Resources issued its first monthly water report of the season, Bulletin No. 120, "Water Conditions in California," on February 1, 1977. The February report generally forecasts a statewide water year runoff averaging 35 percent of normal. (Additional bulletins will be issued March 1, April 1, and May 1, 1977.)

FIGURE 8A

MONTHLY PRECIPITATION PATTERN FOR SELECTED DRY YEARS

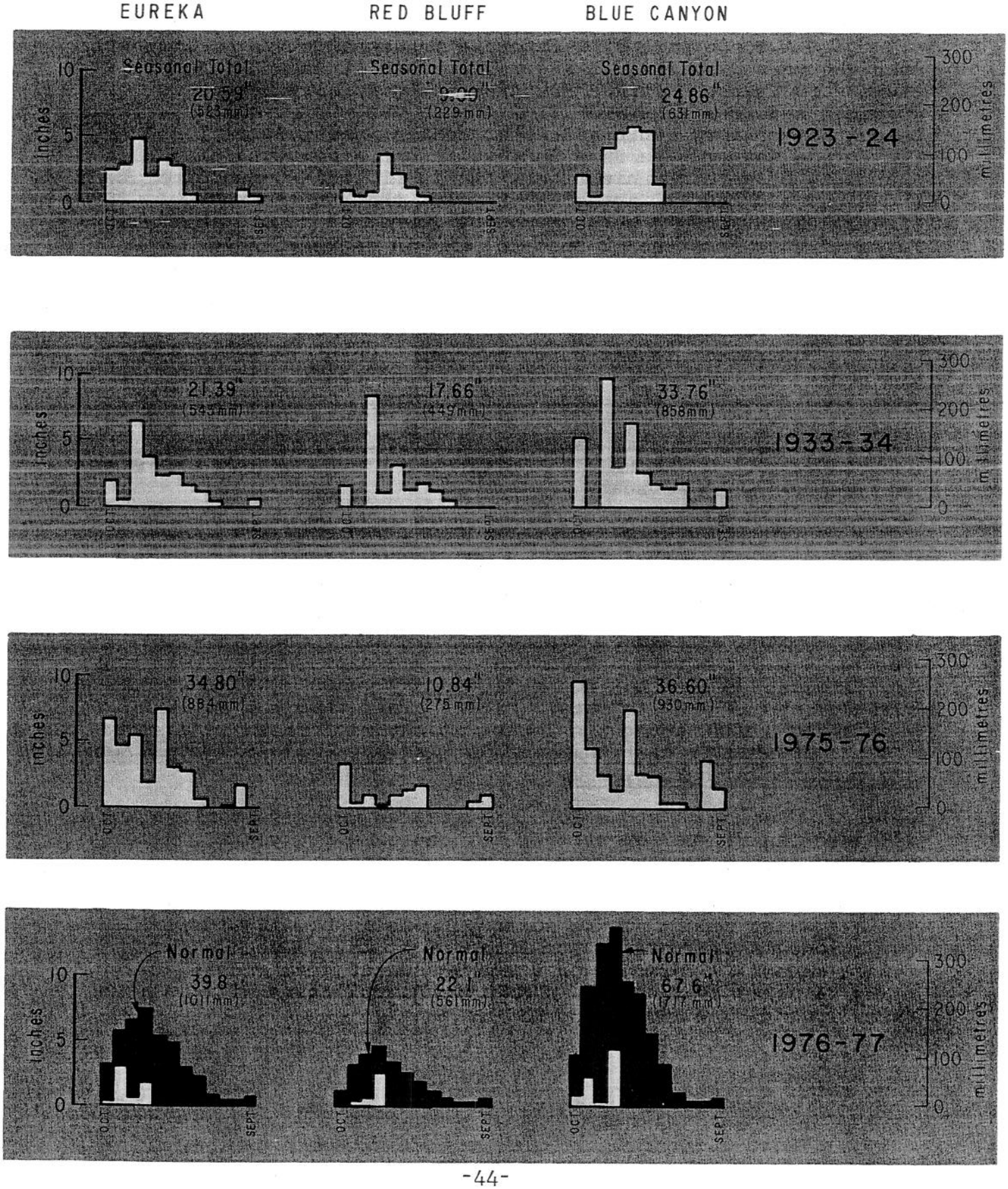


FIGURE 8B

MONTHLY PRECIPITATION PATTERN FOR SELECTED DRY YEARS

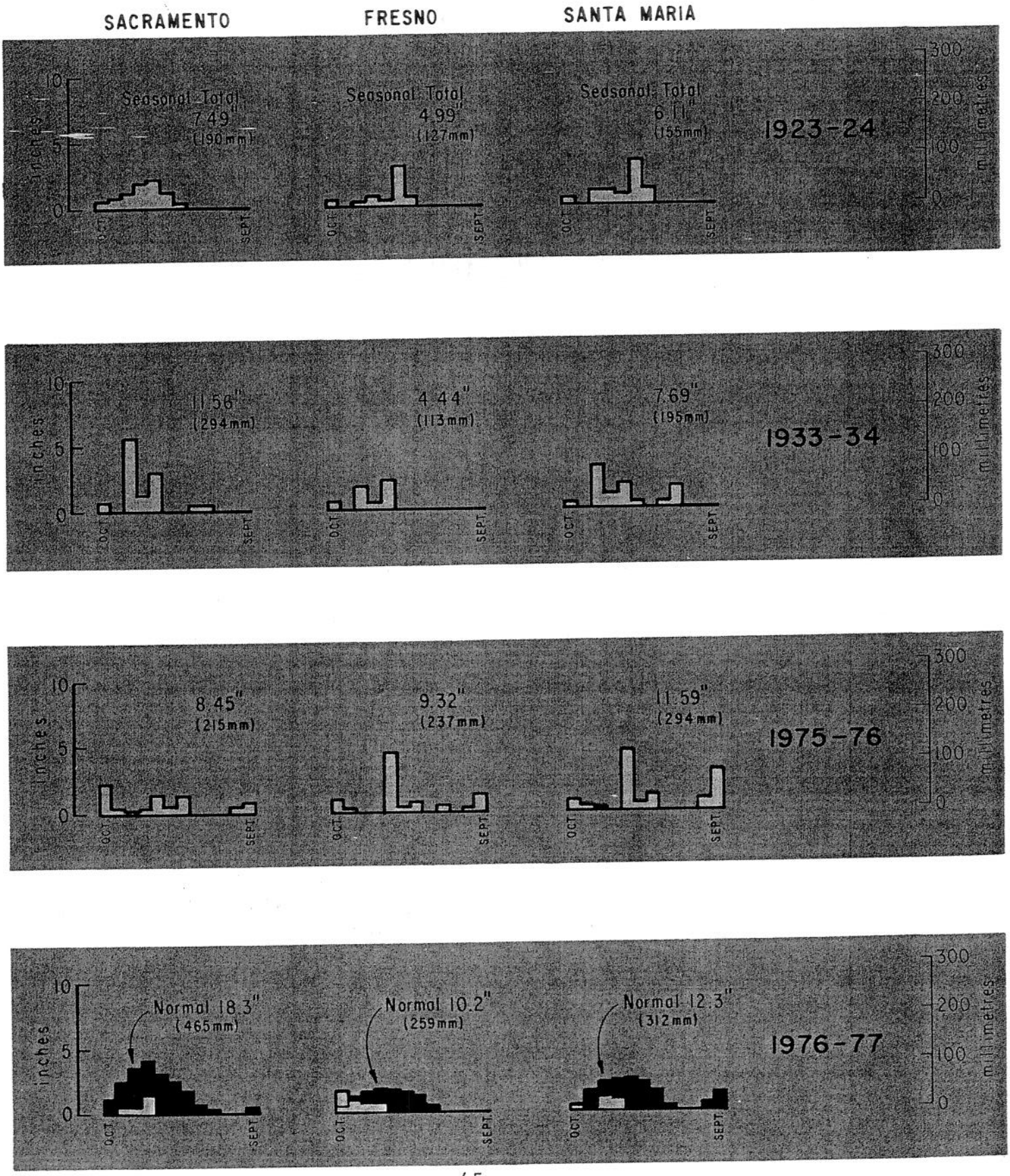


FIGURE 9

SNOW DEPTH AT DONNER SUMMIT

(NORDEN - ELEVATION 7,000 FEET)

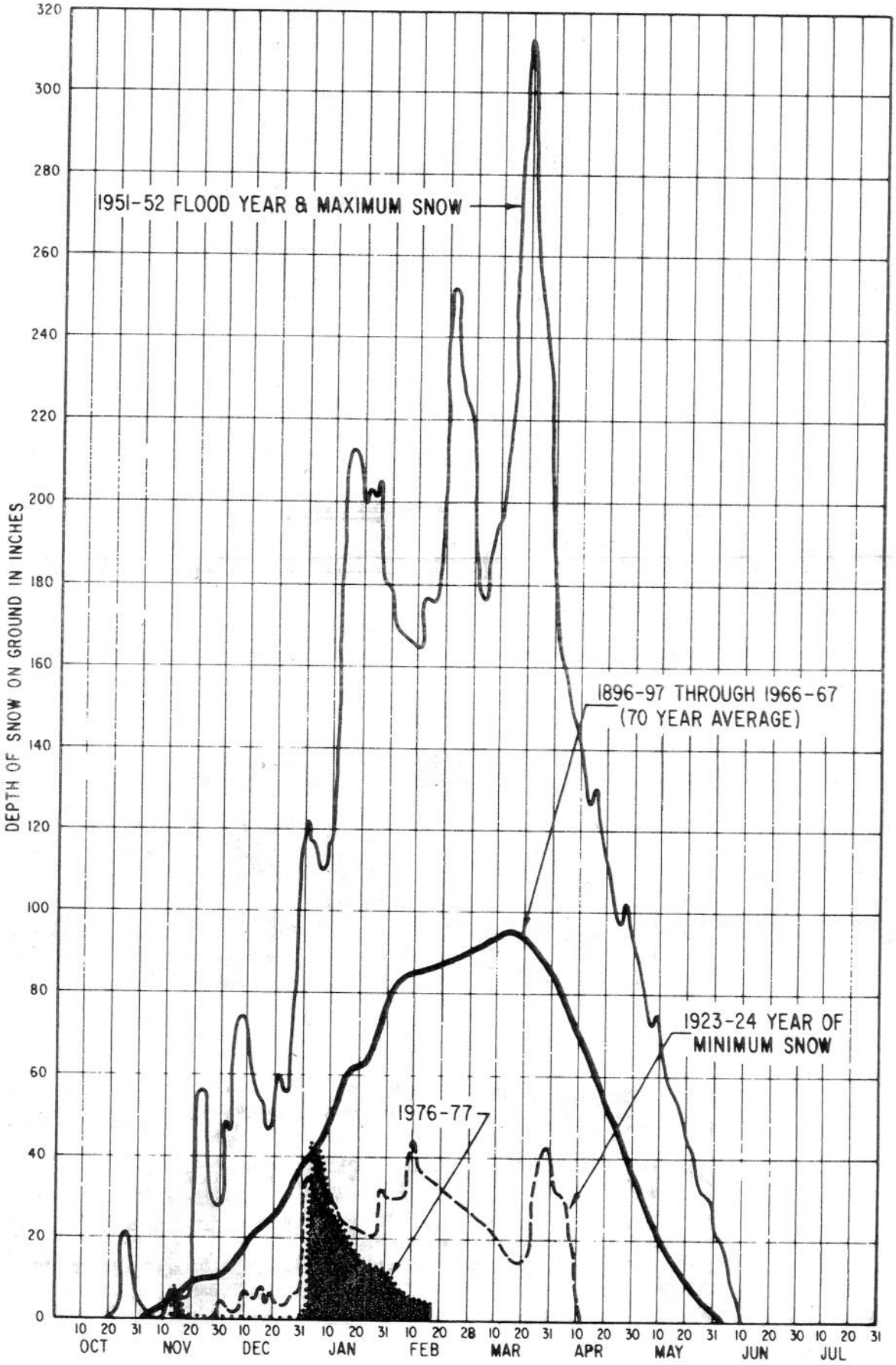


FIGURE 10A

ACCUMULATIVE NATURAL RUNOFF TO SELECTED RESERVOIRS DURING DRY YEARS

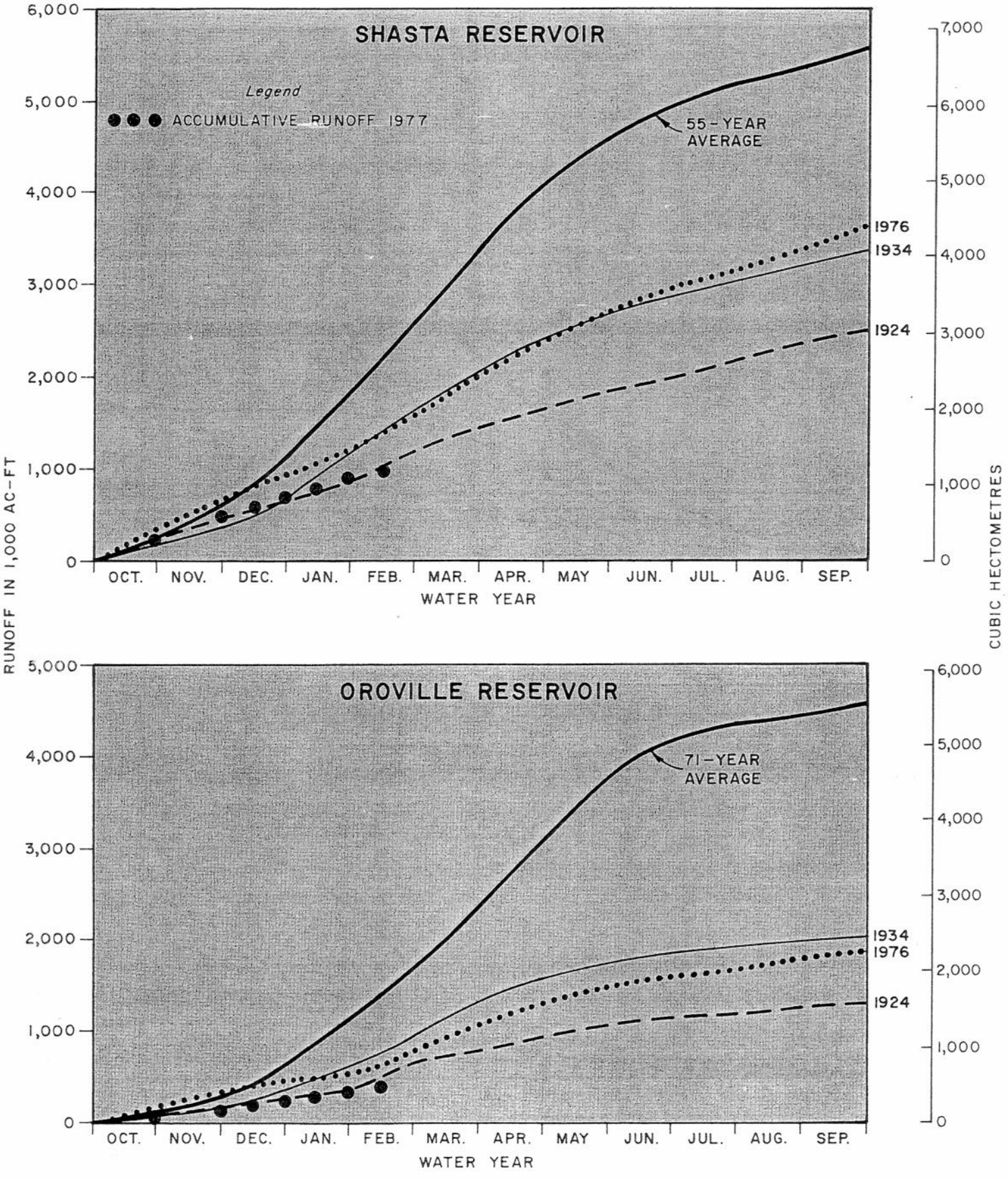


FIGURE 10B

ACCUMULATIVE NATURAL RUNOFF TO SELECTED RESERVOIRS DURING DRY YEARS

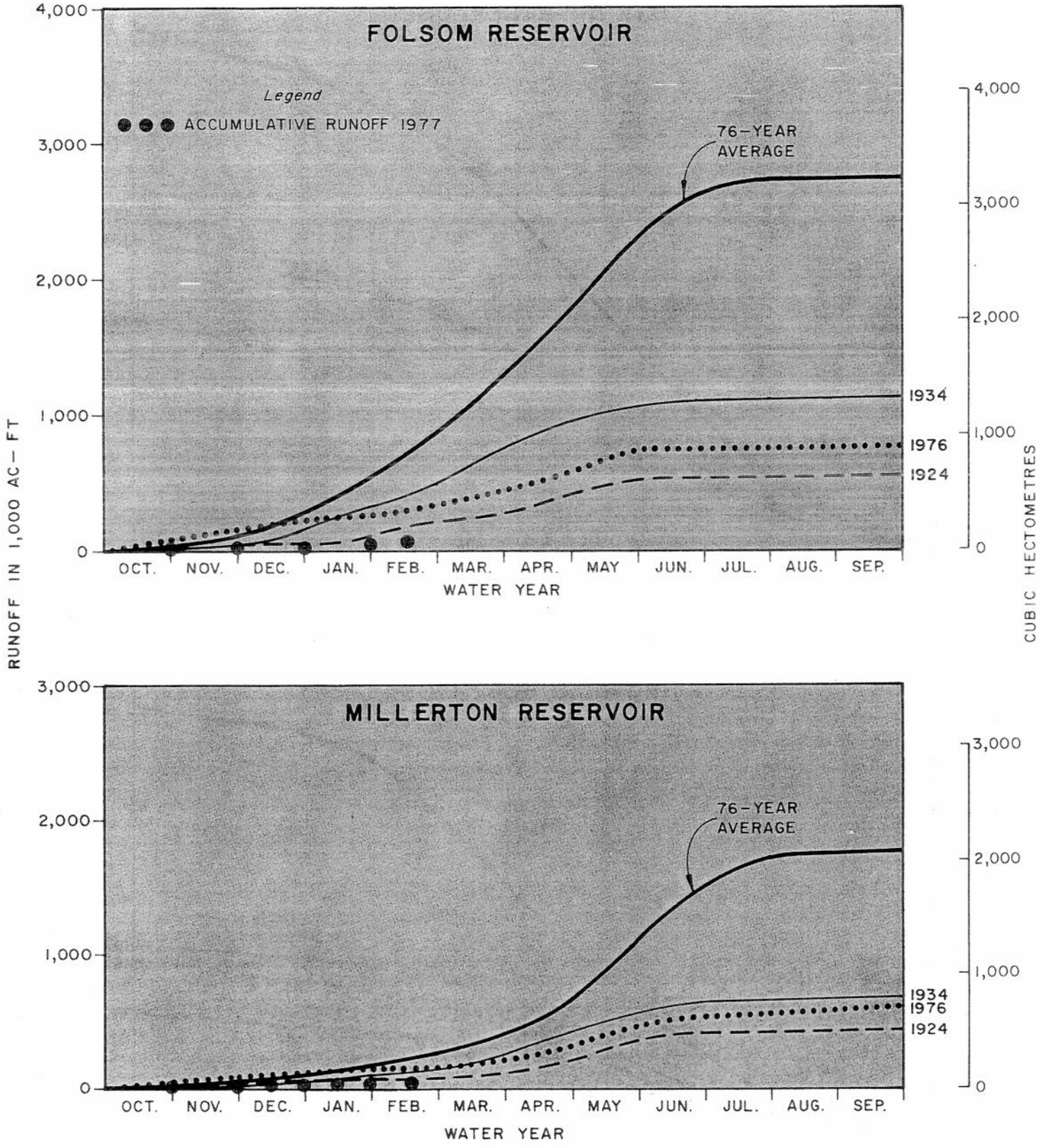
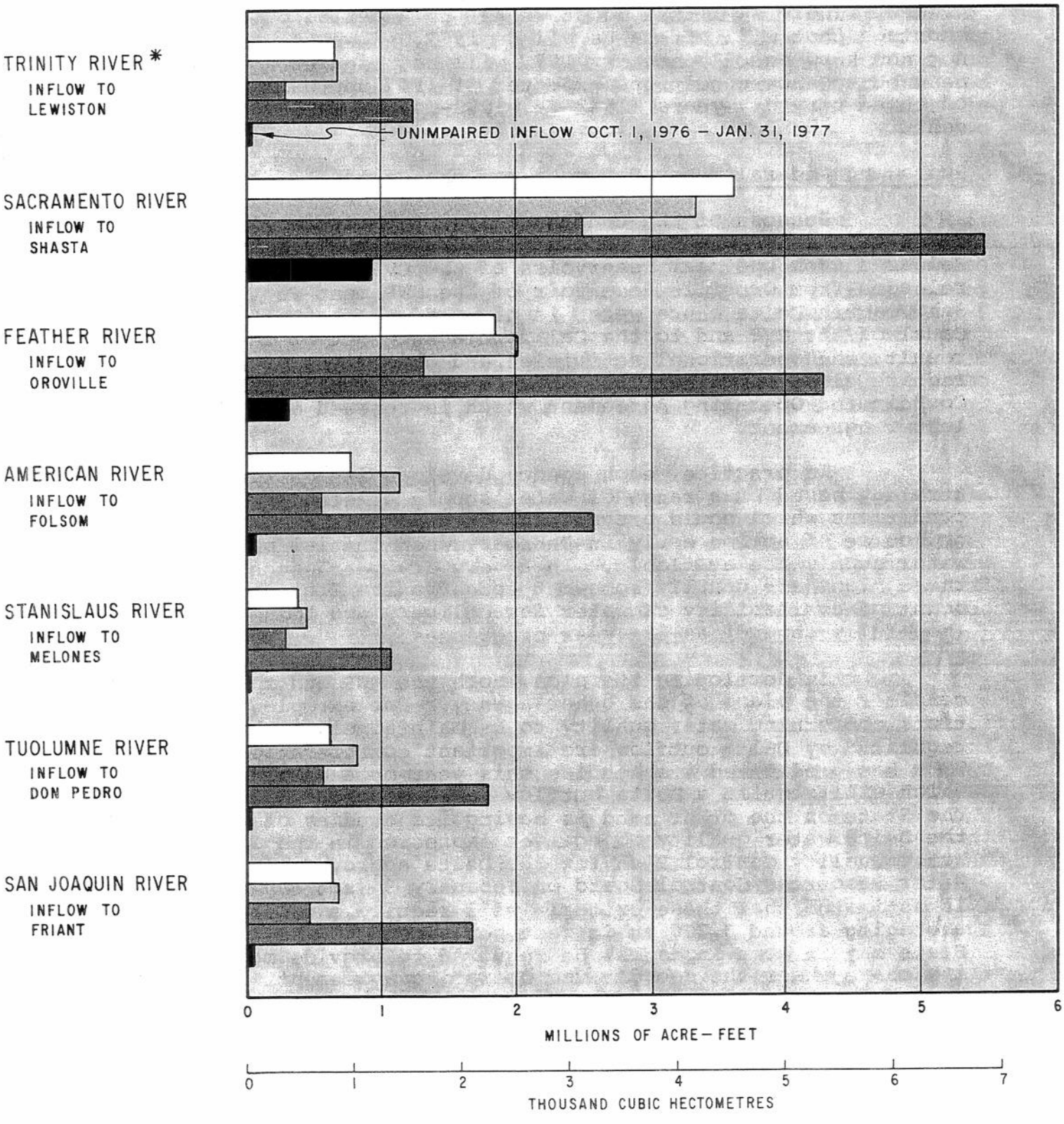


FIGURE 11

UNIMPAIRED WATER YEAR FLOWS FOR SELECTED CENTRAL VALLEY STREAMS



In terms of the minimum requirements to keep California relatively unaffected through the summer months, we can be certain at this time of only about 30 percent of that water actually needed. There is little doubt we are in a period of serious water shortage that will affect us all in 1977. However, since we do not now know exactly how dry 1977 will be, Figures 9 and 10 can be used to show conditions expected if 1977 approximates any one of three very dry years (1923-24, 1933-34, or 1975-76) of this century.

State and Federal Water Projects and the Delta

Because of the configuration of their facilities, operations of the SWP and the federal CVP are mutually interdependent. Releases from upstream reservoirs of the CVP, such as Shasta, and releases from Oroville Reservoir of the SWP meet in the Sacramento-San Joaquin Delta where water is diverted to the Delta-Mendota Canal of the CVP and to the California Aqueduct of the SWP. As a result, the operational activities and objectives of the projects require close coordination. This is accomplished through a Coordinated Operating Agreement which is renewed each year by letter agreement.

In practice, each agency develops its initial operating strategy based on a range of water supply alternatives that span conditions which could prevail and then selects a specific plan or course of action early in February when initial projections of water supply are available. In a very dry year, such as 1977, these plans are usually somewhat conservative from the standpoint of availability of water for delivery and then are adjusted (hopefully upward) as the year progresses.

In developing its plan, both the DWR and the USBR must consider the plans of the other agency. For example, assumptions concerning water quality to be maintained in the Delta as regulated by Delta outflow are important considerations. The USBR has predicated its studies this year on a water quality which will require a Delta outflow index of about 3,000 cfs.[1/] The State on the other hand is basing its studies on maintaining the Delta water quality objectives expressed in the Interim Water Quality Control Plan for the Delta approved by the State Water Resources Control Board on February 8 (see Appendix G). It is estimated that these criteria will require a delta outflow index averaging around 3,200 cubic feet per second.[1/] As a result, the State may in some instances be required to provide more water than its share under the coordinated operating agreement.

1/ One cubic foot per second (cfs) equals 0.028317 cubic metres per second.

Since the USBR does not consider itself required to comply with water quality standards set by the State Water Resources Control Board, it can modify its water quality objectives from day-to-day, depending on operating and policy decisions of its Regional Director. If outflows are reduced by the USBR, the shortage must be made up by the SWP. This procedure places more uncertainty than desirable in SWP operations. The uncertainty is heightened by the USBR's policy of minimal protection to Delta users, even to the extent of exposing its Rock Slough customers to levels of salt content which have been judged hazardous to health by the Department of Health. Legislation to require the USBR to meet the same standards as the SWP is essential to end the currently intolerable situation.

State Water Project

As of October 1, 1976 (beginning of the new water year), Oroville Reservoir, key storage facility for the SWP, contained 1,828,000 acre-feet (2,250 cubic hectometres) of its 3,538,000 acre-foot (4,360 cubic hectometres) capacity. However, Oroville continued to decline due to lack of fall and winter rains and by February 1, 1977, reached approximately 1,607,000 acre-feet (1,980 cubic hectometres) of storage. Total storage in SWP reservoirs on February 1, 1977, amounted to approximately 2.8 million acre-feet (3,450 cubic hectometres).

SWP operators are planning on the basis that the remainder of this spring will be dry, too. The operation plan adopted February 15, 1977, is based upon runoff lower than that occurring in 1924, the record dry year of the century. Under this plan the State Water Project will deliver only about 1,150,000 acre-feet (1,420 cubic hectometres) to its water contract customers in 1977, requiring the imposition of deficiencies to all users. Cuts in entitlement totaling 60 percent will be applied to agricultural uses in the San Joaquin Valley and cuts to municipal and industrial users will amount to 10 percent. The effect of the imposition of deficiencies on deliveries to SWP customers is shown on Table 6. In addition, a 50 percent deficiency, to a maximum of 350,000 acre-feet (432 cubic hectometres), is imposed on Feather River service area users. Deliveries to Feather River users in 1977 are projected to total 593,400 acre-feet (730 cubic hectometres).

In addition to the severe curtailment of project deliveries, storage in project reservoirs will be reduced, in some cases to dead storage. It is anticipated that Lake Oroville will be drawn down to about 1,100,000 acre-feet (1,360 cubic hectometres) in December and that its water will be utilized principally for Delta water quality protection and to provide the reserve needed for 1978. Most of the reservoirs located south of the Delta will be counted upon to supply essentially all deliveries during 1977. Storage in December 1977 in Southern

Table 6

State Water Project
Deliveries and Projected Deliveries
1976 and 1977
(acre-feet)[1/]

	Contracting Agency	1976 Deliveries[2/] Entitlement	1976 Deliveries[2/] Surplus	1977 Entitlement	Projected Delivery[3/]
1.	City of Yuba City	-0-	-0-	-0-	-0-
2.	County of Butte	527	-0-	1,800	1,050
3.	Plumas Co. F.C.&W.C.D.	382	-0-	620	620
4.	Napa Co. F.C.&W.C.D.			6,900	5,455[4/]
5.	Solano Co. F.C.&W.C.D.			-0-	-0-
6.	Alameda Co. F.C.&W.C.D., Zone 7	17,200	3,567	18,400	15,962
7.	Alameda Co. W. D.	21,300	4,147	22,200	19,980
8.	Santa Clara Valley W.D.	88,000	24,805	88,000	75,748
9.	County of Kings	1,600	-0-	1,700	1,530
10.	Devils Den W.D.	11,700	5,727	12,700	5,080
11.	Dudley Ridge W.D.	30,922	30,922	30,400	12,160
12.	Empire West Side I.D.	3,000	3,457	3,000	1,200
13.	Hacienda W.D.	3,900	3,720	4,200	1,680
14.	Kern Co. W. A.	440,700	440,700	483,600	218,990
15.	Oak Flat W.D.	4,039	3,840	3,700	1,480
16.	Tulare Lake Basin W.S.D.	56,358	56,359	54,800	21,920
17.	San Luis Obispo Co. F.C.&W.C.D.			-0-	-0-
18.	Santa Barbara Co. F.C.&W.C.D.			-0-	-0-
19.	Antelope Valley-E. Kern W.A.	27,782	-0-	50,000	23,415
20.	Castaic Valley W.A.	-0-		11,400	4,500
21.	Coachella Valley Co. W.A.	7,600	-0-	8,421	7,579
22.	Crestline-Lake Arrowhead W.A.	1,002	-0-	2,030	1,363
23.	Desert W.A.	12,000	-0-	13,000	11,700
24.	Littlerock Creek I.D.	589	-0-	730	292
25.	Mojave W.A.			20,200	40
26.	Palmdale W.D.			8,220	-0-
27.	San Bernardino Valley M.W.D.	12,273	-0-	57,500	40,592
28.	San Gabriel Valley M.W.D.	6,071	-0-	14,800	9,000
29.	San Gorgonio Pass W.A.			-0-	-0-
30.	Metropolitan W.D. of So. Calif.	628,483	-0-	755,900	676,460
31.	Ventura Co. F.C.D.			-0-	-0-
	Totals	1,375,428	577,244	1,674,221	1,157,796

1/ 1,000 acre-feet equal 1.233 cubic hectometres.

2/ Preliminary values.

3/ Based on 60 percent cuts in agricultural and 10 percent in municipal and industrial entitlements.

4/ Temporarily served from the Putah South Canal of the Solano Project.

California's SWP reservoirs is projected to total only 105,000 acre-feet (130 cubic hectometres), including dead storage and emergency storage.

Under assumptions developed for the plan, state storage (in acre-feet and cubic hectometres) in project reservoirs is anticipated to be as follows:

Reservoir	December 31, 1977	December 31, 1978
Oroville	1,129,000 (1,390)	100,000 (120)
Del Valle	5,000 (6)	5,000 (6)
San Luis	41,000 (51)	4,000 (5)
Pyramid	8,000 (10)	8,000 (10)
Castaic	38,000 (47)	38,000 (47)
Silverwood	43,000 (53)	43,000 (53)
Perris	16,000 (20)	16,000 (20)
Total	1,280,000 (1,577)	214,000 (261)

The operational plan, in terms of total project storage, is shown on Figure 12. The plan does not incorporate the effect of the MWD exchange agreement noted below.

For operation in 1978, the plan assumes that the 1977-78 runoff will be equal to that which occurred in 1923-24, the driest year of record. With this runoff and the 1977 planned carryover storage, the SWP would be required to impose a 50 percent deficiency on agricultural water users and an additional 40 percent on all water contractors. Total deliveries in 1978 would amount to about 766,000 acre-feet (945 cubic hectometres) of which only 65,000 acre-feet (80 cubic hectometres) would be available for agricultural users. Table 7, below, shows projected 1978 SWP deliveries to agricultural, municipal, and industrial users.

FIGURE 12

TOTAL STATE WATER PROJECT STORAGE

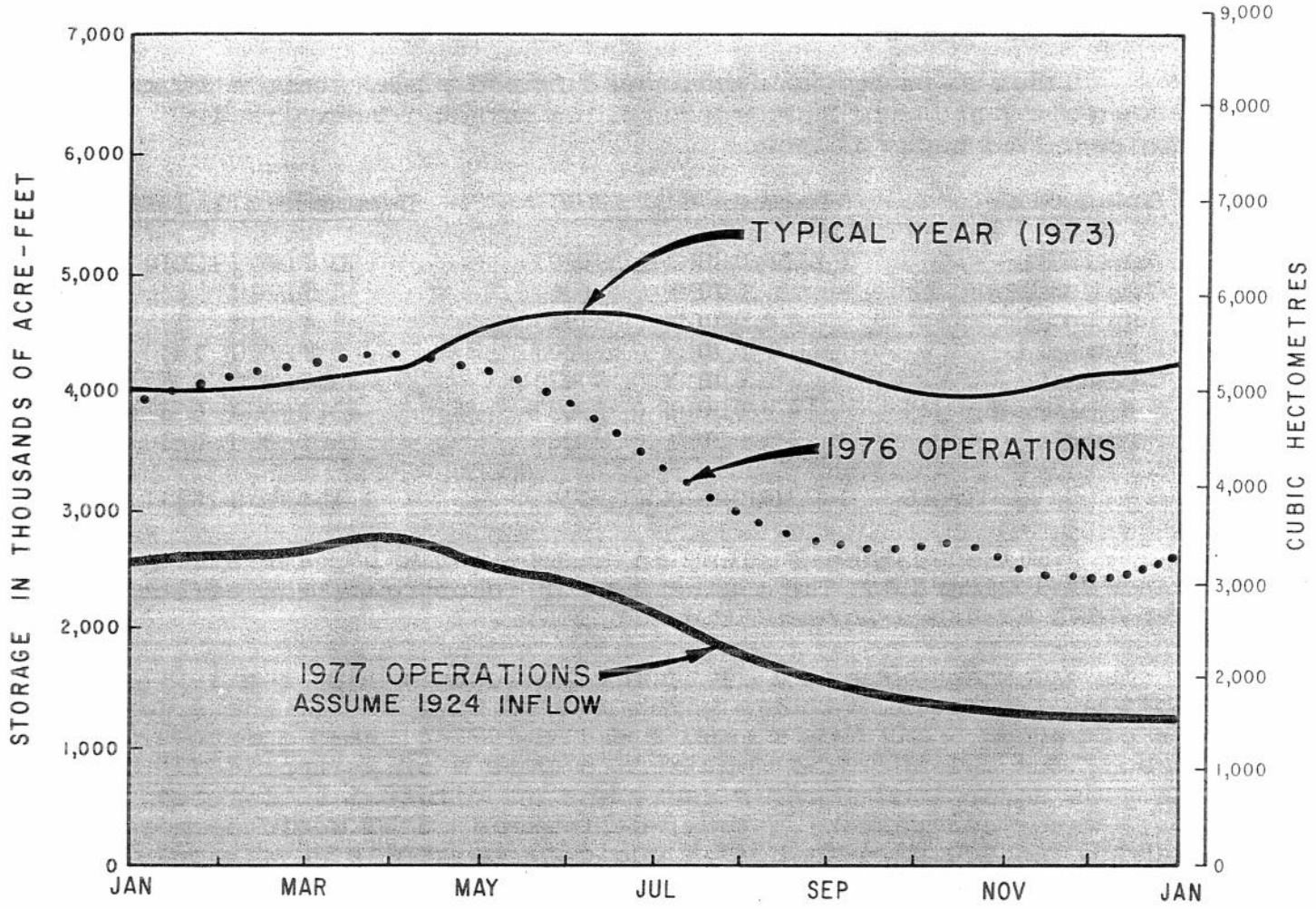


Table 7

Projected 1978 SWP Deliveries
acre-feet (cubic hectometres)
(Under DWR 2/15/77 Operations Plan)

	M&I	Ag	Total
1978 request	1,165,233 (1,437)	660,126 (814)	1,825,359 (2,251)
Shortage reduction	-465,354(40%) (574)	-594,113(90%) (733)	-1,059,467 (1,306)
Balance Available to deliver	699,879 (863)	66,013 (81)	765,892 (945)
MWD Share (may be exchanged with Northern California)	508,980 (628)	800 (1)	509,780 (629)
All Others	190,899 (235)	65,213 (80)	256,112 (316)

As a result of this operation, total storage in water project reservoirs, including Oroville, would be reduced to about 214,000 acre-feet (261 cubic hectometres) in December 1978.

An exchange agreement with MWD of Southern California, one of the SWP customers, provides that up to 400,000 acre-feet (490 cubic hectometres) of its 1977 entitlement will be freed for use in Northern California to relieve drought impacts there. The MWD acted to increase its use of Colorado River water instead. Negotiations are underway to distribute the supply made available by the exchange to areas of greatest demand, principally the San Francisco Bay area and the San Joaquin Valley.

The above discussion clearly demonstrates that the SWP agricultural customers, particularly those in the San Joaquin Valley, will be severely impacted in 1977. For example, the Kern County Water Agency users near Bakersfield will receive only 218,990 acre-feet (2,700 cubic hectometres) of water from the SWP in 1977. This compares with 1976 deliveries of 881,400 acre-feet (1,090 cubic hectometres). The Agency has indicated that an additional 500,000 acre-feet (616 cubic hectometres) could be pumped to make up deficiencies in all its surface water supplies (CVP, SWP, and the Kern River). To avoid a strain on the well drilling industry and consequent delays to the agricultural producer, plans must be laid now to complete needed wells before high water demands this summer.

Central Valley Project

The U. S. Bureau of Reclamation (USBR), operator of the CVP, has announced that its operating policy for 1977 is based on the assumption that California is now facing a second consecutive dry year, so that it is forced to reduce deliveries to its customers and it will be unable to provide flows sufficient to maintain water quality standards in the Delta. The following discussion is separated to follow along the lines of its two major operational systems, the northern and the southern systems. For additional information refer to the USBR report titled, "Dry Year Operations Policy, Central Valley Project", dated January 1977.

The northern portion of the CVP includes Shasta, Trinity, Folsom, Whiskeytown, and San Luis Dams. The water supply developed by this system serves a major portion of the Sacramento and San Joaquin Valleys. The USBR plan provides for 1977 reductions of 75 percent in contract entitlement deliveries to all agricultural users south of the Delta, and cuts of 25 percent to all users with water rights to the Sacramento River system. Municipal and industrial reductions will be 50 percent. Carryover storage in northern system reservoirs will total less than 1,500,000 acre-feet (1,850 cubic hectometres) at the end of 1977. The plan, in terms of reservoir storage, is shown on Figure 13.

In planning for 1978, the USBR is assuming 1977-78 runoff amounts equal to those of 1923-24, driest year of record. These amounts, coupled with carryover from 1977, would not permit delivery of any water to agricultural users south of the Delta. Projected CVP deliveries in 1978 under the 1977 operations plan would be:

Agricultural Users	2,420,000 Acre-feet	(2,984 cubic hectometres)
Municipal and Industrial Users	140,000 Acre-feet	(172 cubic hectometres)
Total	2,560,000 Acre-feet	(3,156 cubic hectometres)

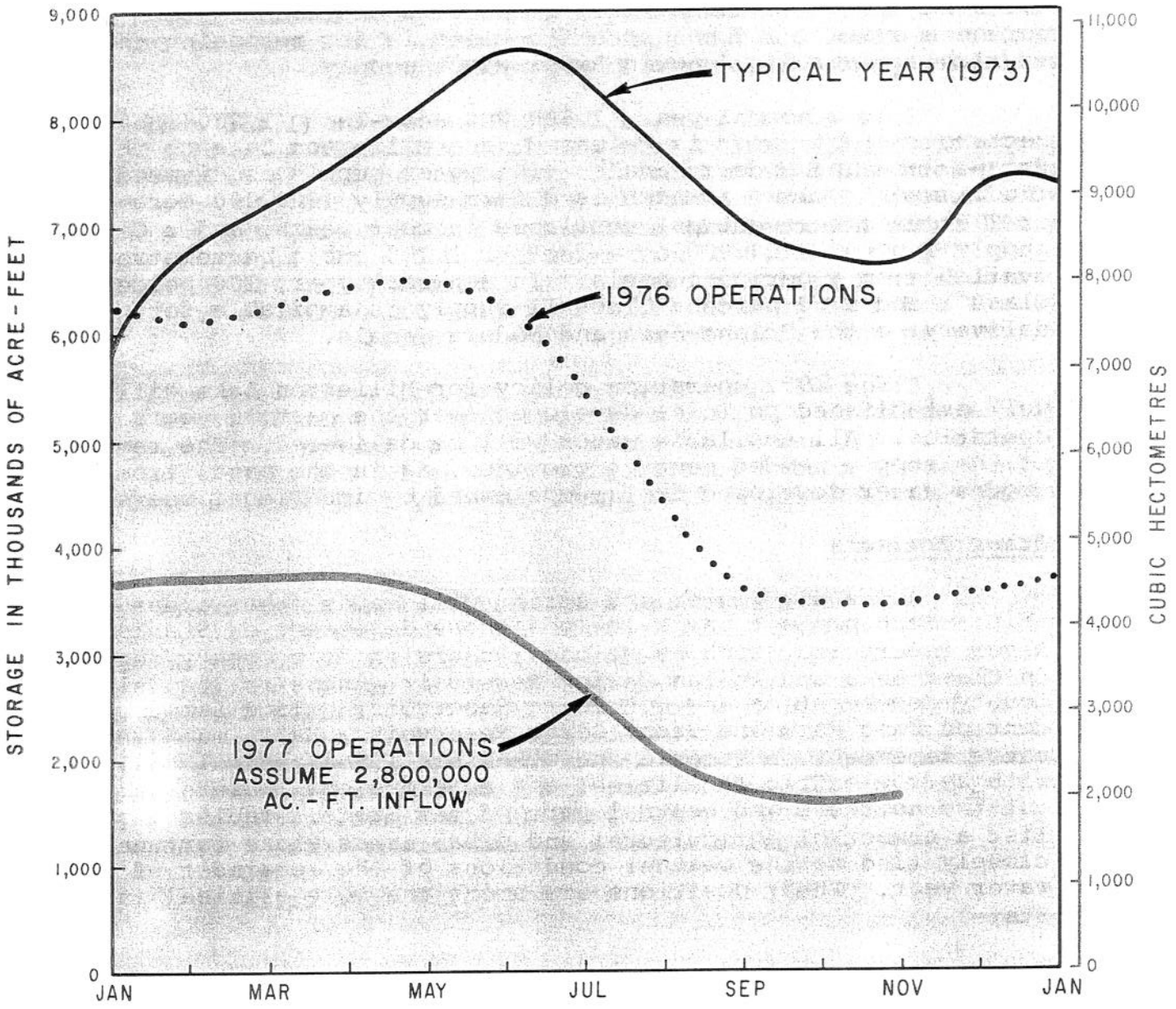
Under assumptions for the plan, CVP storage (in acre-feet and cubic hectometres) is anticipated to be as follows:

Reservoir	October 1, 1977	October 1, 1978
Shasta	710,000 (875)	360,000 (444)
Trinity	320,000 (395)	310,000 (382)
Folsom	90,000 (111)	30,000 (37)
Whiskeytown	220,000 (271)	30,000 (37)
San Luis	120,000 (148)	40,000 (49)
Total	1,460,000 (1,800)	770,000 (949)

The above figures assume that 75,000 acre-feet (92 cubic hectometres) would be made available to East Bay MUD in 1977.

FIGURE 13

CENTRAL VALLEY PROJECT STORAGE



The southern system of the CVP includes Friant Dam, Millerton Lake and the Friant-Kern and Madera Canals. This system serves a major portion of the eastern San Joaquin Valley. The southern system is essentially isolated operationally from the northern system, and has specific criteria for rationing the available upper San Joaquin River water supply.

In a normal year, 1,500,000 acre-feet (1,850 cubic hectometres) of water is released from Millerton Lake to the Friant-Kern and Madera Canals. The water supply is divided into two classes: Class I which is a firm supply (800,000 acre-feet or 990 cubic hectometres) available in most years, and a Class II supply (up to 1,400,000 acre-feet or 1,730 cubic hectometres) available on a periodic basis. In a normal year, 100 percent Class I and a 50 percent Class II supply is available for delivery to the Friant-Kern and Madera Canals.

The 1977 operation policy for Millerton Lake will follow well established policies developed over the past 30 years of operation. All available water will be delivered. The remainder of the supply needed must be provided, as in the past, from ground water developed from pumps owned by individual users.

Other Projects

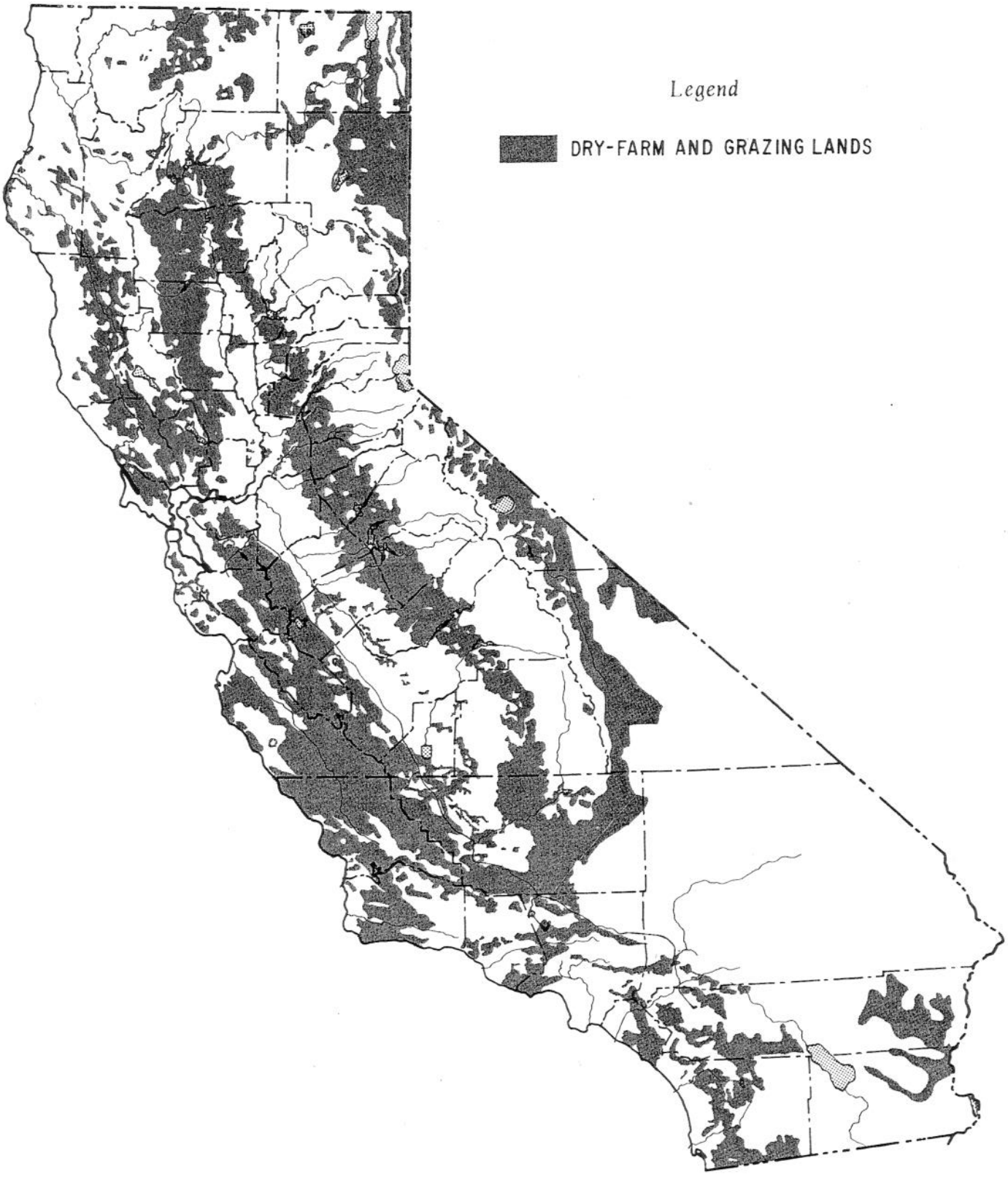
The dry winter and spring will cause other areas hardship. Such project users include those dependent on Stanislaus River reservoirs, such as Melones; users in Yolo County dependent on Clear Lake and Indian Valley Reservoir; users in Stanislaus County dependent on New Don Pedro Reservoir; Orland farmers dependent on East Park and Stony Gorge Reservoirs; Marin municipal users dependent on Nicasio and other small reservoirs; utilities with hydroelectric facilities; and numerous small users throughout the northern and central part of the State. Tables 7 and 8 list a number of agricultural and urban areas whose fortunes are closely tied to the weather conditions of the remainder of the water year. Their positions are among the more critical in the State.

Dry-Farmed Agriculture

Figure 14 shows the areas of the State generally recognized as dry farming lands and rangeland. As in 1976, those areas located in Northern and Central California are again bearing the immediate brunt of the drought. The President, on January 20, 1977, declared 23 counties eligible for subsidy aid under PL 93-288, and another 14 counties were added on February 2, 1977. This action will free federal funds for emergency livestock feeding and other programs to mitigate effect of the drought upon the livestock producer.

FIGURE 14

DRY-FARM AND GRAZING LANDS OF CALIFORNIA



In addition, 15 counties are currently being considered for eligibility for "Economic Injury" loans, administered by the Small Business Administration, as a result of drought impact upon their industries.

The winter of 1978 must be much wetter than normal in order for rangeland to recover. Conditions experienced the last two years (lack of seed setting, overgrazing and loss of cover) carry the potential for increased damage from erosion in 1978. Hay and feed prices can be expected to rise again, and beef prices drop, causing additional economic loss to California livestock producers.

Irrigated Agriculture

Over 90 percent of the losses caused by drought in 1976 were in the nonirrigated portion of agriculture. While it is expected that these losses will continue during 1977, they will be compounded by substantial losses in the irrigated sector of agriculture. Many reservoirs which were nearly full in 1976 are now at, or near, record lows. The result of the 1976 drought is best illustrated in Table 2 (page 6) comparing 1975 fall reservoir storages with those of 1976. Present storage levels are far too low to accommodate a similar drawdown on irrigation reservoirs in 1977.

Unless California receives a great deal of rainfall and snowfall during the next three months, irrigated agriculture will suffer substantial losses during 1977. The severely reduced runoffs projected, together with remaining reservoir contents shown in Table 8, are not sufficient to supply agriculture's irrigation water requirements. As previously noted, under continuing drought conditions both the CVP and the SWP are expected to curtail agricultural water deliveries.

Independent irrigation districts will suffer losses in agricultural production commensurate with the degree of water shortage existing in each area. Table 8 lists a number of potentially seriously affected agricultural areas; many listed thereon will have insufficient surface water to meet full irrigation needs. They include the Browns Valley Irrigation District in Yuba County with only 29 percent of the water needed in 1977 presently stored; the El Dorado Irrigation District, El Dorado County, 20 Percent; Jackson Valley Irrigation District, Amador County, 59 percent; Nevada Irrigation District, Nevada and Placer Counties, 36 percent; South Sutter Irrigation District, Sutter County, 0 percent; Yolo County Flood Control and Water Conservation District, 0 percent; Oakdale and South San Joaquin Irrigation Districts, Stanislaus and San Joaquin Counties, 11 percent; Turlock Irrigation District, Stanislaus County, 12 percent; Merced Irrigation District, Merced County, 37 percent; and the Orland Water User's Association, Glenn County, 3 percent.

Table 8

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
NORTHERN DISTRICT							
Anderson-Cottonwood Irrigation District	Sacramento River; CVP	184,146	175,000	131,250[1/]	30,000[2/]	Adding concrete pipelines and turnouts; conservation.	Reduce operations.
Corning Canal Service Area	Sacramento River; CVP	38,998	39,000	11,225[1/]	28,000[2/]	No additional sources. Installing pipelines and gates; conservation.	Reduce applied water and eliminate some deliveries.
Tehama-Colusa Canal Service Area	Sacramento River; CVP	55,000	70,600	46,775[1/]	23,000[3/]	No additional sources.	Some deliveries eliminated.
Glenn-Colusa Irrigation District	Sacramento River; Black Butte Reservoir; CVP	957,300	920,000	618,750[1/]	200,000[2/]	Capture and reuse of tailwater; conservation; water allocation plan.	40-50% reduction in rice acreage.
Orland Unit Water Users Association	Stony Gorge; East Park; Black Butte	82,715	125,000	4,000	121,000	Applied for federal grant for drilling 30-70 new wells.	Drastic reduction in irrigated acreage.
Princeton-Codora-Glenn Irrigation District	Sacramento River, Drains; CVP	91,431	90,000	50,857[1/]	17,000[2/]	Ground water, but probably not in immediate future.	Change in crop pattern.
Provident Irrigation District	Sacramento River; well; 2047 Drain; CVP	73,602	70,000	41,047[1/]	8,000[2/]	Two wells being developed.	42% less planting.
Reclamation District No. 108	Colusa Basin Drain; CVP	220,000	220,000	174,000[1/]	None[2/]	3 new wells have been developed.	Required to pump ground water.

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

1/ Amounts available from CVP after cuts in entitlement (estimated, based on plan adopted 2/15/77).

2/ Estimated, based on difference between 1976 CVP deliveries & projected 1977 CVP deliveries under plan adopted 2/15/77.

3/ Estimated, based on difference between demand and projected 1977 CVP deliveries under plan adopted 2/15/77.

Table 8 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
NORTHERN DISTRICT (Continued)							
Butte Jt. Water District Butte WD Biggs-West WD Richvale ID Sutter Ext. ID	Feather River	662,000	625,000	337,500	287,500	May purchase 2,000 AF from MWD and purchase well water from individuals.	50% reduction in rice acreage. Pasture damage.
Western Canal Service Area	Feather River	226,000	226,000	113,000	113,000	Will make up deficit from PG&E, Lake Alamanor.	No new customers.
CENTRAL DISTRICT							
Banta-Carbona Irrigation District	San Joaquin River; Delta Mendota Canal	70,000	70,000	4,200	20,000	No additional sources. Allocate available supplies.	Reduce acreage. Sugar beet and grain lands left fallow.
Browns Valley Irrigation District	Merle Collins Reservoir and Yuba River	49,000	50,000	15,000	24,500	--	Reduction in irrigated acreage -- pasture and rice.
East Contra Costa Irrigation District	Indian Slough; Wells	45,000(s) 5,000(g)	50,000		10,000	Increase pumping from Delta. Intertie with Byron Bethany ID.	Loss of deciduous and truck crops.
El Dorado Irrigation District	Jenkinson Lake; American River; Webber Creek Reservoir	36,000	33,000	7,000	12,000 to 18,000	Working with USBR and PG&E for possible supplies from PG&E and N. Fork Cosumnes. "Lifeline" (increasing block rate) regulations adopted. Conservation.	Reduction in crops, or area served. Moratorium on annexations and new service.
Jackson Valley Irrigation District	Lake Amador	11,000	11,000	6,200	4,800	Allocate available supplies.	Change crop pattern -- reduce delivery.

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

Table 8 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
CENTRAL DISTRICT (Continued)							
Nevada Irrigation District	Yuba River Bear River	140,000	140,000	44,000	76,000	No additional sources other than from PG&E. Reductions to M&I and agric. users. Adding water meters.	Reduced deliveries to orchards and pasture.
Stockton-East Water District	New Hogan Reservoir; Wells	72,000	41,000(s) 31,000(g)	None	41,000	Plan to lease wells and install bigger pumps.	Increase in pumpage and cost.
Solano Irrigation District	Lake Berryessa; Wells	212,000	215,000	Allocation of Lake Berryessa storage	None	Wells; recapture of tail water. Cutting allocation to 2.7 acre-feet per acre.	Changed crop pattern expected to result in less tomatoes. No double cropping.
South Sutter Water District	Camp Far West Reservoir	101,166	110,000	None	110,000	Possibly purchase from PG&E. Individual wells.	Reduced rice acreage -- change crop pattern.
Woodbridge Irrigation District	Camanche Reservoir	75,855	116,700	75,855	40,800	Wells	
Yolo County Flood Control and Water Conservation District	Clear Lake; Indian Valley Reservoir; Wells	76,000 plus ground water	160,000	None	91,000	Increase use of ground water pumping.	Reduced crop acreage (10-40,000 acres) or change in pattern.
SAN JOAQUIN DISTRICT							
Central California Irrigation District	Delta-Mendota Canal; 53 wells	703,807	555,000(s)	417,500[4/]	137,500[4/]	Cutting allocation to 3.0 acre-feet per acre. Working with Agric. Extension on conservation.	Reduced crops.

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

[4/] Assuming 25% cut in CVP deliveries.

Table 8 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
SAN JOAQUIN DISTRICT (Continued)							
Delano-Earlimart Irrigation District	Friant-Kern Canal	80,665 Plus ground water	146,000	-0-	81,000[5/]	Will increase use of wells.	Lowering of ground water level -- some land out of production.
Shafter-Wasco Irrigation District	Friant-Kern Canal	34,000 Plus ground water	69,800	10,000	40,000[5/]	Will increase use of wells.	Lowering of ground water level -- some land out of production.
Fresno Irrigation District	Pine Flat Reservoir; Wells	200,000 plus ground water	600,000	--	Not known	Will increase use of wells.	
Friant-Kern Service Area	Millerton Lake	600,000	1,457,290	240,000	967.000[5/]	Will increase use of wells.	50,000 acres of permanent crops on short supply.
Friant-Kern Hill Districts	Millerton Lake	79,000	122,000	73,000[5/]	49,000[5/]	No ground water available.	Will not be able to meet crop requirements.
Kern County Water Agency	State Water Project	883,000	1,402,000	218,990[6/]	664,000[7/]	Wells; possible exchange with the MWD of Southern California.	Significant reduction in irrigated acreage. Increased cost of pumping.
Kings River Water Association	Pine Flat Reservoir	750,000	1,500,000	250,000	--	Increase use of wells.	Further ground water overdraft. Increased power use.

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

5/ Assuming 40% cut in CVP Class I & no Class II.

6/ Based on 60% cuts in SWP entitlement.

7/ Based on difference between 1976 SWP deliveries and projected 1977 SWP deliveries under plan adopted 2/15/77.

Table 8 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
SAN JOAQUIN DISTRICT (Continued)							
Merced Irrigation District	McClure Reservoir; Wells	540,000(s) 200,000(g)	740,000	200,000	340,000	Increase use of wells. Encouraging cutbacks in field planting and use of crops using less water.	Continue rationing methods -- raise price of water and reduce rice acreage.
Modesto Irrigation District	Don Pedro Reservoir; Wells	274,000(s) 90,000(g)	397,640	234,000	72,000[8/]	Increase use of wells. May delay start of season. Discourage non-agricultural use.	Small garden plots will get less water.
Monterey County Flood Control and Water Conservation District	Nacimiento and San Antonio Reservoir; Wells	Principal use is from private wells.	290,000(s) for ground water recharge.		None		
North Kern Water Storage District	Kern River; Wells	140,000	140,000	38,000	None	Increase use of wells.	No crop loss but greater lowering of ground water level.
Oakdale and South San Joaquin Irrigation Districts	Melones Tulloch, Beardsley, Donnells Reservoirs	300,000(s) 300,000(g)	600,000	34,000	170,000[8/]	Increase use of wells.	Sixty thousand acres permanent crops could be damaged; also effect on pasture land
South Santa Clara Valley Water Conservation District	Uvas, Llagas Creeks; Wells		31,000 plus ground water	32	31,000	Increase use of wells; conservation.	Expect some idled land and/or crop damage. Deepened wells.
Turlock Irrigation District	Don Pedro Reservoir; Wells	777,000(s) 164,000(g)	941,000	92,000	616,000[8/]	Increase use of wells.	

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

8/ Based on projected 30% of normal April-July runoff.

Table 8 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED* AGRICULTURAL AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Source of Supply	1976 Use, Acre-feet**	1977 Demand, Acre-feet**	Carryover Surface Water Available, Acre-feet**	Net Deficit Acre-feet**	Potential Sources and Contingency Plans	Adverse Impacts
SAN JOAQUIN DISTRICT (Continued)							
Westlands Water District	San Luis Canal	1,284,000(s) 200,000(g)	1,200,000(s) 300,000(g)	252,000[9/]	948,000[9/]	Increase use of wells.	Cuts in acreage Increased pumping costs.
Tulare Lake Basin Water Storage District	State Water Project	115,610	283,100	60,800	222,300	Increase use of wells.	Reduced crop acreage. Lowered water levels.

* Areas which experienced drought impact in 1976 with expected impact in 1977, plus major agricultural areas.

** 1,000 acre-feet equal 1.233 cubic hectometres.

9/ Based on projected 75% cut by CVP.

Figure 15 is a graphic representation of the extent of the problem. Districts and agricultural areas will have to apportion water according to individual circumstances. This means that added pumping, decreased acreage, reduced water use (and consequent yield), and elimination of double cropping will all be factors leading to economic loss to the farmer greater in 1977 than experienced in 1976.

The farmer has traditionally borne the risks associated with variability of the weather. In California some of these risks are, of necessity, being taken now as farmers make the planting decisions for their 1977 summer crops. At this point in time, it is almost certain that there will be major decreases in agricultural production, resulting in major economic loss.

The State Department of Food and Agriculture will make periodic detailed reports on the economic injury to California agriculture. The first report is due June 1977 with updates in September and December, 1977.

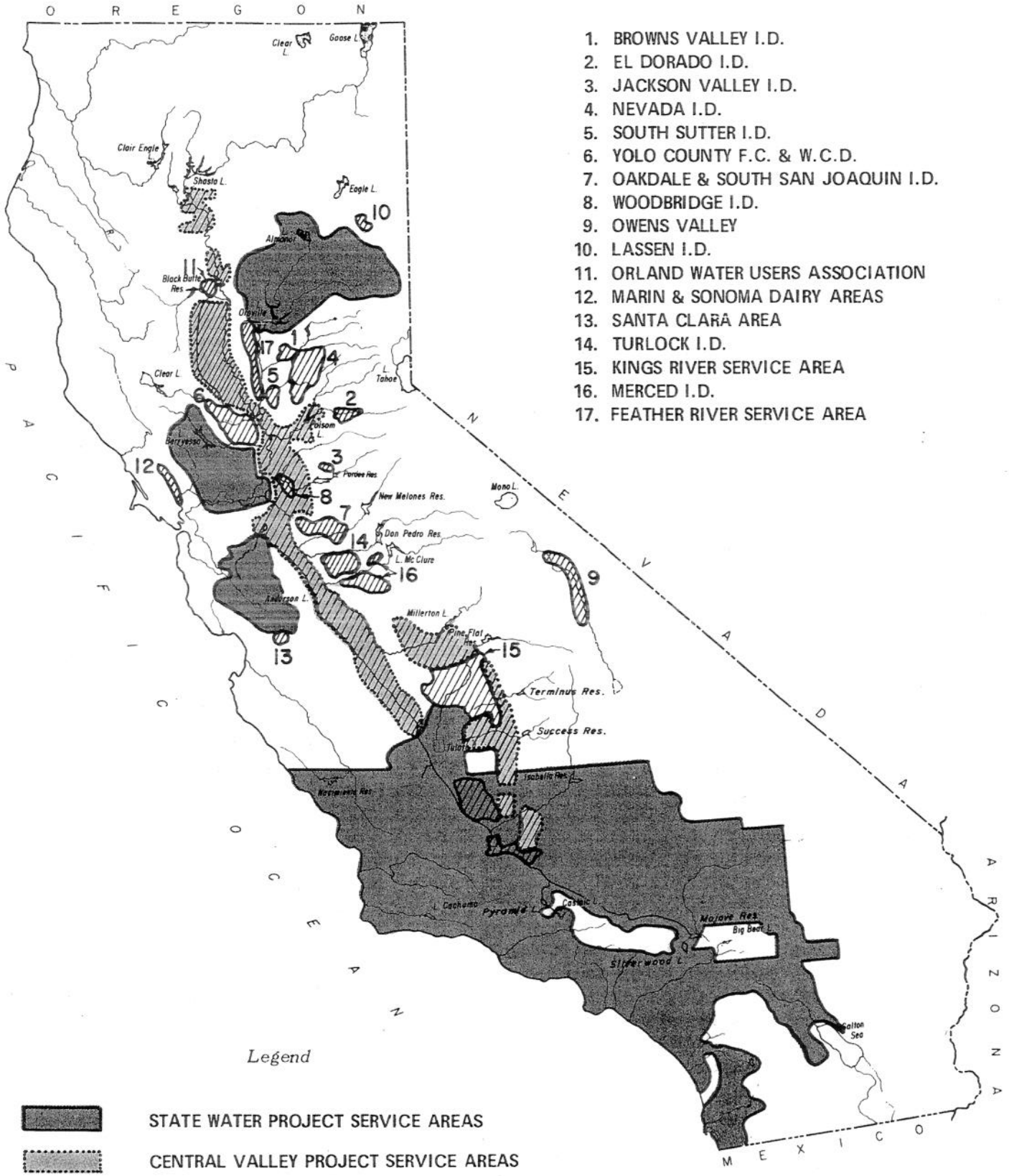
Urban Areas

Current trends are compounding problems felt by small communities last year, since most of the 1976 solutions were simply temporary expedients whose capacity to improve the situation was limited. The cumulative effect of two dry years is causing some major urban systems, which made it through 1976 adequately, to fail in 1977. Listed in Table 9 are a number of communities that can expect to join the list of approximately 50 feeling the effects of the drought in 1976. A number of these communities must actively pursue effective conservation programs now if they wish to avoid rationing later. Even with conservation, rationing is a certainty for many communities (some of whom are noted on Table 9).

Late in January 1977, the San Francisco WD announced a voluntary program (for its 2.0 million customers) as did the MWD of Southern California. On February 8, 1977, East Bay MUD, recognizing the darkening situation, announced the undertaking of a mandatory conservation program to replace the voluntary program begun earlier. The mandatory program has as its goal a 25 percent reduction in usage and will provide an enforced total of 280 gallons per day per residence, based on an average household of 3 persons. On March 8 the District board will be asked to consider rate hikes up to 30 percent for their 1.1 million customers. Meanwhile Marin MWD, serving 180,000 people and the hardest hit of major urban areas last year and again in 1977, embarked on February 1, 1977, on the strictest major water rationing program yet instituted by California communities. Its plan provides an enforced maximum of 32 to 49 gallons per day (dependent on number of household members) for each resident for all uses, coupled with a doubling of the unit cost. This programmed usage compares with the statewide urban average of over

FIGURE 15

POTENTIAL DROUGHT IMPACTED AGRICULTURAL AREAS, SUMMER 1977



1. BROWNS VALLEY I.D.
2. EL DORADO I.D.
3. JACKSON VALLEY I.D.
4. NEVADA I.D.
5. SOUTH SUTTER I.D.
6. YOLO COUNTY F.C. & W.C.D.
7. OAKDALE & SOUTH SAN JOAQUIN I.D.
8. WOODBRIDGE I.D.
9. OWENS VALLEY
10. LASSEN I.D.
11. ORLAND WATER USERS ASSOCIATION
12. MARIN & SONOMA DAIRY AREAS
13. SANTA CLARA AREA
14. TURLOCK I.D.
15. KINGS RIVER SERVICE AREA
16. MERCED I.D.
17. FEATHER RIVER SERVICE AREA

Legend

- STATE WATER PROJECT SERVICE AREAS
- CENTRAL VALLEY PROJECT SERVICE AREAS
- DROUGHT AREAS

Table 9

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
NORTHERN DISTRICT:							
Alturas, City of	Wells	1,200	1,011	0	None expected.	Existing well at cemetery.	Providing conservation advice.
Cedarville County WD	Well	325	328	0	None expected.	New well to be drilled in spring 1977.	
Cohasset[4] (Butte County)	Wells & springs	80	50	0	[3]	Individual hauling from Chico.	Borrow 4-5,000 gallon water truck from OES and haul from Chico.
Elk Creek (Glenn County)	Stony Gorge Res.	115	151[2]	150	None expected.	Individual wells.	Use of wells.
Forest Ranch[4] (Butte County)	Wells	50	40	0	[3]	Individual hauling from Chico.	Sharing from wells and individual hauling.
Humboldt Bay Municipal WD[4]	Ruth Res. plus Mad Riv. Div.	61,300	61,300	16,600	Deficit expected.	Wells in Mad River Plain.	Cut water to pump mills before cutting urban uses. May consider a conservation plan before cutting mills.
Kelseyville[4]	Wells	280	300	0	Deficit expected.	Clear Lake.	New well being drilled to tap deeper aquifer; one existing well being deepened. Pumping from Lake.
Lakeport, City of[4]	Wells	700	700	0	Deficit expected.	Clear Lake.	
Lime Saddle Comm. SD[4]	Wells, PG&E's Miocene Canal	55	40	0	[3]	Deep well funded by emergency loan.	Individual hauling.
Lower Lake Co. Water Works Dist. #1[4]	Wells	150	150	0	Deficit expected.	Drilling new well. Clear Lake.	Voluntary conservation. Use of well with taste problem. Curtail unnecessary use.
Magalia County WD[4]	Wells & PG&E's Hendricks Canal	51	50	0	15	An additional well is planned.	Emergency purchases from PG&E's Hendricks Canal.
Mountain Gate Community SD[4]	Lake Shasta & wells	600	500	175	100	Lake Shasta. Purchase of 100 AF from Redding.	Conservation-no sprinkler use permitted on Sunday and odd or even days depending on customer's address.

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
NORTHERN DISTRICT: (continued)							
Paradise Irrig. Dist.[4]	Paradise & Magalia Res. on Little Butte Ck.	7,880	5,675	2,500	2,000	Emergency purchases from PG&E's Hendricks Canal and Del Oro Mine.	Continue effective conservation measures begun early in 1976. Negotiating with PG&E.
Stonyford[4] (Colusa County)	Wells	30	25	0	[3]	Possible hauling by tank truck.	
Susanville	Springs & wells	2,550	2,300	0	None.	Storage for surplus flow from springs could be developed.	
Westwood Comm. SD	Spring	550	560	0	None	Diversion from Goodrich Creek.	
Willits, City of[4]	Morris Res. on James Creek, P.G.&E.	1,000	1,000	220	Deficit expected.	Little Lake Valley ground water could be developed.	Rationing similar to Marin County's if 1977 continues dry.
CENTRAL DISTRICT:							
Alameda Co. FCWCD	SWP Water EBMUD Wells	20,000	21,000	15,962	2,438	Bay area exchanges.	Voluntary conservation (13%).
Alameda CWD[4] Fremont Union City Newark	SWP Alameda Creek City of S.F.	46,700	51,138	19,980	2,220	Bay area	Voluntary conservation (10%). Water saving devices. Possible 25% reduction.
Big Basin (Santa Cruz Co.)	Spring Wells, Tank	138	106	1		Drill wells.	Irrigation limited to 2 days per week, public education on conservation measures. Water Saving devices.
San Lorenzo WD Boulder Creek[4] (Santa Cruz Co.)	Wells, Local Res. stream.	1,020	1,160	250	150	Wells, reclaimed water.	Voluntary conservation (10%).
Calistoga[4]	Kimball Res., wells.	588	588	55	533	Reclaimed water. Geothermel well.	Outside water use prohibited for 2nd year. Increase in rates.
Coastside County Water District[4] Half Moon Bay Pascadero	Pilarcitos Lake Denniston Creek	1,600	1,467	1,230	410	8 new wells. Reclaimed water Pipe to Crystal Springs Res.	Conservation (10%) limited delivery, no new connections.

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
CENTRAL DISTRICT: (continued)							
Contra Costa County Water District	Contra Costa Canal; Delta	120-130,000	130,000	96,000	30,000	Exchange with EBMUD, reclaimed water, wells.	Mandatory conservation (24%). Temporary intake at Middle River thru EBMUD Aqueduct.
Copperopolis Improvement District[4]	Penny Creek	16	8	2	14	None	No outside watering.
Cotati, City of[4]	Sonoma Co. W.A., wells	330	316(s) 46(g)	[8]	[8]	Ground water (up to 560 acre-feet total)	Moratorium on new connections. Voluntary conservation (15%). Restricted outdoor watering. Mandatory reduction (25%) March 1.
El Dorado Irrigation District[4]	Jenkinson Reservoir, American Riv.	35,000	36,000	7,000	12,000 to 18,000	PG&E, USBR. Reclaimed Water.	Restricted outside uses. Increased price.
Felton[4]	Wells	170	170	None	-	None	No outside irrigation, no permits for additional construction.
Foresthill PUD[4]	Wells	239	132	0	Deficit expected.	Possible old mine tunnel.	Prohibit outside use except hand watering--allowing no new connections. Plan used last year and cut usage by nearly 50%.
EBMUD[4] Oakland Berkeley Castro Valley San Leandro San Lorenzo Albany El Cerrito Richmond	Mokelumne R., Local Res.	246,000	246,000	166,000	40,000	CVP supply from Middle River.	Mandatory rationing (25%) currently in effect.
Marin Municipal WD[4] San Rafael Sausalito Mill Valley Corte Madera Larkspur San Anselmo Belvedere Tiburon Fairfax Kentfield Ross Terra Linda	6 Res.	32,300	24,000	12,300	20,000	EBMUD, SFWD & SWP	Continuation of rationing (57%). Exchange agreement to get SWP water from MWD entitlement.

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1/] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF7/	1976 Use AF7/	Carryover Surface Water Available AF7/	Net Deficit AF7/	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
CENTRAL DISTRICT: (continued)							
Napa, City of	Lake Hennessy Lake Milliken	12,800	13,800	17,000	None	Wells, North Bay Aqueduct	Voluntary conservation (20%).
North Marin County WD[4/] Novato Ignacio	Russian R. Lake Stafford	7,000	6,400	4,000	3,000	Wells	Restricted outside use March 1, mandatory rationing June 1 at 50 gpd per person.
Petaluma, City of[4/]	Wells; Spr.; Local Res. Russian R.	5,500	5,336	46+8/	8/	Reclaimed water.	Install water-saving devices, restrictions on outside watering. Pressure reduction.
Pine Acres[4/]	Wells, Tank	49	41	0.2		Additional wells.	Voluntary conservation and increased water rates.
Pine Grove	Well	7	7			None	Voluntary conservation.
Pioneer[4/]	Antelope Cr.	120	89	1	Deficit expected.	Private well. New tank for storage.	Truck in water, rationing (55%) under way. Water saving devices.
Plymouth[4/]	Cosumnes R.					Private well.	Curtail outside water use.
Rohnert Park, City of	Sonoma Co. W.A., wells	1,700	400(s) 2,100(g)	8/	8/	Ground water (up to 3,920 acre-feet total)	Phased plan adopted, with final phase to eliminate outside irrigation and new connections.
Sacramento, City of	Sacramento, American, Wells	84,000	89,000	None	None	Reactivation of abandoned wells.	Voluntary conservation (20%). Interties with local districts and private water companies.
Sacramento County	Sacramento, Cosumnes, American. Wells	850,000	800,000	None	None	Folsom South Canal	Voluntary conservation (30%, northeast). Interties between districts and private water companies.
San Francisco WD[4/] San Francisco Hayward San Mateo Redwood City Daly City El Granada Montara	Hetch Hetchy Local Res.	300,000	308,000	207,000	34,000	None	Voluntary conservation (10%). Considering mandatory program (25%).

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
CENTRAL DISTRICT: (continued)							
Santa Clara Valley Water District[4] Milpitas San Jose Santa Clara Sunnyvale Palo Alto	SWP Local Res. Wells	234,000(s) 156,000(g)	400,000	33,400	-	Wells, reclaimed water.	Reduce agricultural acreage; voluntary conservation (10%); waste water reclamation. Water saving devices.
Santa Cruz, City of[4]	San Lorenzo River Coast Streams Wells	12,000	12,000	3,000	9,000	New wells.	Voluntary conservation (22%). Restricted outside use.
Santa Rosa, City of[4]	Sonoma Co. W.A., wells	12,900	13,500(s) 1,700(g)	[8]	[8]	Ground water (up to 5,600 acre-feet total)	Phased plan expected to save 50%. Restrictions on outside use in effect. Final phase is 50 gpd per person.
Sonoma, City of[4]	Sonoma Co. W.A., wells	1,300	1,300(s)	[8]	[8]	Ground water (up to 1,900 acre-feet total)	Voluntary conservation (15%). Mandatory (25%) on March 1.
Sonoma County WA (Direct Service Area Only)[4]	Russian R. Eel R.	56,000	63,000	50,000[5]	Unknown	Ground water	Mandatory conservation by March 1, added wells, exchanges.
St. Helena[4]	Wells Bell Res.		1,228	0		Added well.	Mandatory rationing in effect - 75 gpd per person or 300 gpd per family. Restricted outside use. Water saving devices installed.
Stinson Beach[4]	Wells Creeks	1,500	1,100	3	Deficit exists.	Possibly barge water in by Navy Tanker. 2 new wells.	Close state park, serve only local people. Increase water charges, water saving devices, no outside irrigation.
Vallejo, City of	Cache Sl. Local Res. Lake Hennessy	21,000	20,541	None	-		Voluntary conservation (10%). No new service outside city.
Valley of the Moon County WD[4]	Sonoma Co. W.A., wells	1,900	1,420(s) 160(g)	[8]	[8]	Ground water (up to 900 acre-feet total)	Mandatory rationing (25.30%). Final phase is 50 gpd per person. Moratorium on new service.

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
SAN JOAQUIN DISTRICT:							
Bakersfield	Wells			0	None		No shortage anticipated.
Bass Lake	Creek	276	276		None		No shortage anticipated.
Bodfish (Kern County)	Wells			0	None	Added new well; plan another.	Standby well has been leased.
Fresno	Wells		67,000	0	None		No shortage anticipated.
Marina[4]	Wells			0	Yes		Rationing if necessary.
Mariposa[4]	Wells Stockton Creek Res.			25		2 new wells completed. Planning to drill several more.	No lawn watering. No school showers. Plan to haul water, if necessary.
Monterey Peninsula[4] Monterey Seaside Carmel Del Rey Oaks City of Sand Pacific Grove	Wells Carmel R. Los Padres San Clemente Res.	17,000	16,042	1,123		Wells	Mandatory rationing in effect. Plan larger pipeline from Carmel Valley and treatment plant for ground water.
Tulare	Wells		6,178	0	None	Reclaimed water.	No shortage anticipated.
Watsonville	11 Wells					New well.	
Wofford Hgts.,[4] (Kern County)	Wells	189	189	0	None	Added new well; plan another.	Rationing if necessary.
SOUTHERN DISTRICT:							
Avalon-Catalina Island	Wells	339	366	300		None	Importation by ship.
Big Bear Lake Village	Wells			0	Unknown	Interconnection with Big Bear City Service.	Additional wells drilled. A study of joint use with Big Bear City Service is proposed.
Goleta[4] (Santa Barbara Co.)	Cachuma Res. & Wells	15,500	16,233	7,400	3,000	USBR from Cachuma Res. & City of Santa Barbara.	Restrictions on outside watering in effect. Comprehensive plan prepared and available, if needed.
Leona Valley (Los Angeles Co.)	Wells		97	0		SWP water will be available in July 1977.	No new hookups until SWP water available.

Table 9 (Continued)

WATER SUPPLY CONDITIONS IN SELECTED[1] URBAN AREAS
(Data Current as of February 15, 1977)

Local Agency or Area	Type of Supply	Normal Demand AF[7]	1976 Use AF[7]	Carryover Surface Water Available AF[7]	Net Deficit AF[7]	Opportunities for Supplemental Supplies	Contingency Plans (if necessary)
SOUTHERN DISTRICT: (continued)							
Los Angeles, City of	Owens Valley, MWD, Local Sources.	584,000	474,000 25,000 119,600	30,000 115,000	None	MWD	Voluntary conservation (10%).
Metropolitan Water District[6]	Colorado Riv. & SWP	1,570,000	1,713,000[9]	-	None	Colorado River	Additional 320,000 AF from Colorado River to replace equivalent SWP water. Voluntary conservation (10%).
Montecito Co. WD Santa Barbara		4,000	4,053			SWP	Moratorium on new service and rationing in effect since 1973.

1/ Areas which experienced drought impact in 1976 with known or potential impact in 1977, plus major urban areas.

2/ Had leaking storage tank.

3/ Not known - Individual wells.

4/ Areas where rationing is a distinct possibility for 1977.

5/ May not reach Sonoma because of agricultural use upstream.

6/ MWD serves water to its constituent member districts and other agencies covering an area of about 5,000 square miles in Ventura, Los Angeles, Orange, San Bernardino, Riverside, and San Diego Counties.

7/ 1,000 acre-feet (AF) equal 1.233 cubic hectometres.

8/ Figures dependent on Sonoma Co. W.A. allottments from Lake Pillsbury, not yet determined.

9/ Figure is sum of Colorado Aqueduct and SWP supplies plus ground water.

200 gallons per day per capita - with some large communities (unmetered) averaging over 300 gallons per day per capita usage. Conservation goals for major San Francisco Bay area agencies are shown on Figure 16.

In the Monterey Peninsula area, served by a private utility, mandatory conservation began February 19 for approximately 100,000 people. Enforced rationing will provide 50 gallons per capita per day for domestic users and 80 percent and 50 percent of 1976 amounts for industrial and golf course users, respectively.

Clearly, the seriousness of the situation has been recognized by many Californians; many more must do so while there is still water to conserve. Table 10 (listing metropolitan areas accounting for 80 percent of the State's urban use) shows how much water can be saved with various levels of effort. The amounts are significant. For example, the San Francisco Bay area can reduce its consumption by 250,000 acre-feet (308 cubic hectometres) simply by cutting back 25 percent (an achievable goal). Total savings for the 11 areas listed would be nearly one million acre-feet (1,233 cubic hectometres) at the same level of effort.

Recreation

As dry conditions have persisted into 1977, the winter sports and water-oriented segments of this industry have already been extremely hard pressed. Snow has been sparse and snowpack has been thin, and some resorts have attempted to compensate with man-made snow.

The effect of two dry years in a row will be great on lake-oriented recreation because of the current extremely low storage. Although it is difficult to imagine that conditions worse than those of 1976 are possible, it is certain that worse conditions will be the rule in 1977. Some locations less severely affected in 1976 will be substantially impacted in 1977. For example, Clair Engle Lake (behind Trinity Dam in Trinity County), which experienced a 38 percent drop in recreational usage in 1976 despite being held relatively stable during the season, is being drawn down to well below normal in the winter of 1976-77 to supply winter needs, while Lake Shasta has an opportunity to increase its storage. Water levels at Lake Shasta in 1977, however, will again be below boat ramp levels. All reservoirs on the SWP system, including Oroville, San Luis, Pyramid, Castaic, Silverwood, and Perris, will be affected as their waters are withdrawn to meet SWP needs. All Southern SWP reservoirs will experience extreme drawdown forcing curtailment of recreational activities.

The East Bay MUD has announced that its Pardee Reservoir (east of Stockton) may not be opened to recreation at all

FIGURE 16

CONSERVATION GOALS BY MAJOR WATER AGENCIES IN THE SAN FRANCISCO BAY AREA

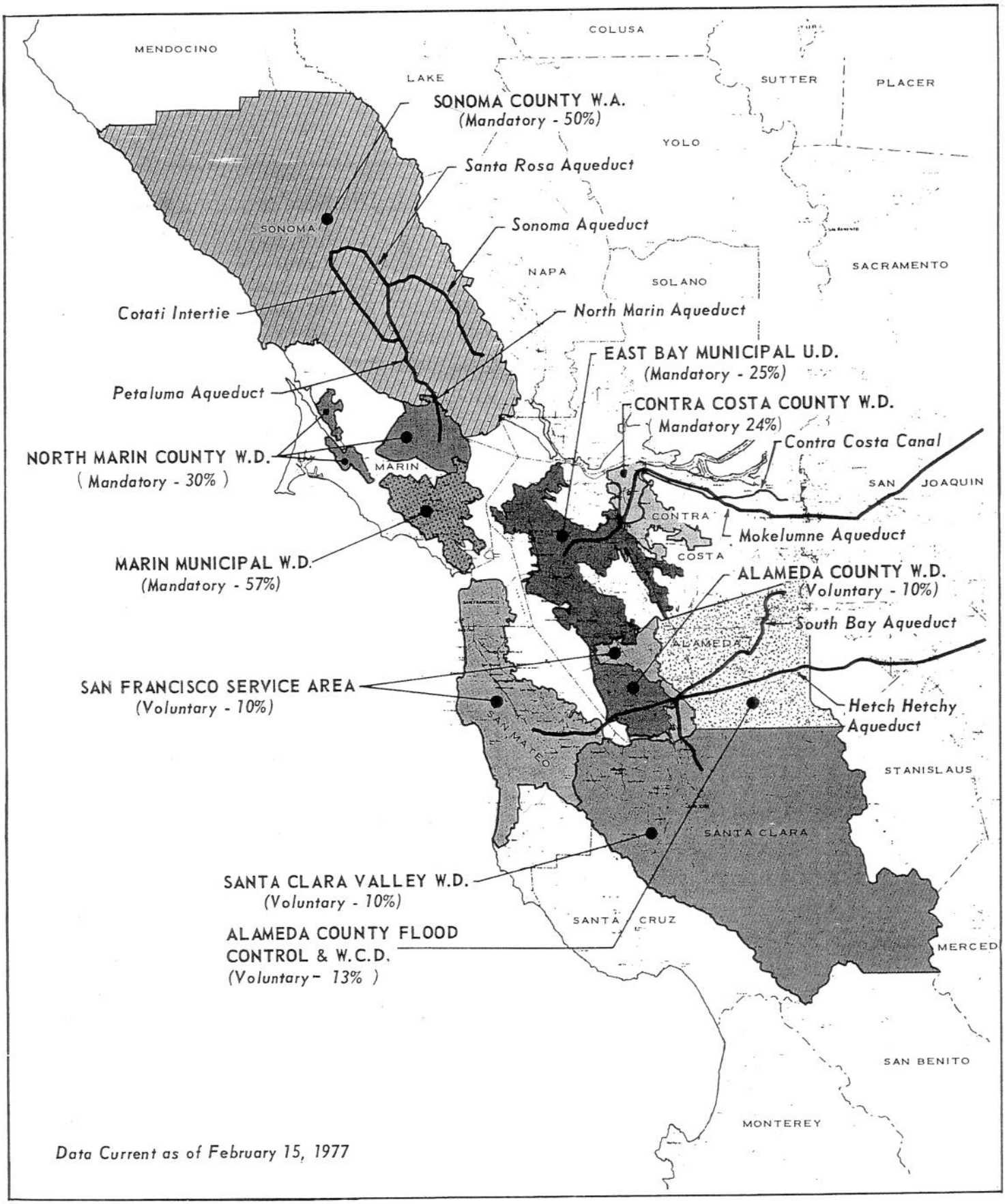


Table 10

LOCAL WATER SAVINGS POSSIBLE* WITH REDUCTIONS IN URBAN WATER USE
Acre-feet
(cubic hectometres)

Metropolitan Area	10% Reduction	20% Reduction	30% Reduction
San Francisco Bay Area	100,000 (123)	200,000 (247)	300,000 (370)
Sacramento[1/]	20,000 (25)	40,000 (49)	60,000 (74)
Fresno[1/]	15,000 (19)	30,000 (37)	45,000 (56)
Stockton	7,500 (9)	15,000 (19)	22,500 (28)
Bakersfield[1/]	13,000 (16)	26,000 (32)	39,000 (48)
Modesto[1/]	7,500 (9)	15,000 (19)	22,500 (28)
Santa Cruz	2,500 (3)	5,000 (6)	7,500 (9)
Monterey	4,000 (5)	8,000 (10)	12,000 (15)
Santa Barbara	5,000 (6)	10,000 (12)	15,000 (19)
Los Angeles Area	200,000 (247)	400,000 (493)	600,000 (740)
San Diego Area	22,000 (27)	44,000 (54)	66,000 (81)
Totals	396,500 (486)	793,000 (972)	1,189,500 (1,458)

[1/] Principally unmetered.

* Based on 1972 usage figures.

Note: The areas noted account for 80 percent of the State's urban use.

in 1977. Whether it will open depends on snowfall in the next several months. Pardee, normally opened to recreation in mid-February, has launching ramps extending down to elevation 540; the water level on February 15 was at elevation 470.

As Table 5 illustrates, a number of other reservoirs came very close to receding below lowest boat ramp levels in 1976. Many of these will be less fortunate in 1977. Among those reservoirs expected to experience problems are Antelope, Bucks, Camanche, Folsom, Jackson Meadows, McClure, Melones, Mendocino, Oroville, Rollins, Scotts Flat, Shasta, Tulloch, and Union Valley.

The Sacramento-San Joaquin Delta area is an exception to the poor conditions generally experienced by water-related recreation. The water levels of its 700 miles (1,130 kilometres) of waterway remain relatively unaffected by the drought, and boaters and other users will be provided nearly normal recreational opportunities.

Fish and Wildlife

If present critically dry conditions persist through 1977, the impact on fish and wildlife will be severe. The results of low water on coastal anadromous fish streams have already been apparent. During December and January, salmon and steelhead piled in the lower portions of major streams where they were subjected to poaching and predation losses. King Salmon were forced to spawn in less suitable areas within the lower reaches of the larger streams. Some river tributaries and smaller coastal streams have been so low that adult silver salmon and steelhead have either not been able to spawn successfully or have not been able to ascend them at all.

Within the Central Valley, during the fall of 1976, King Salmon were able to ascend most of the major spawning streams without impairment, with the exception of the Cosumnes, Mokelumne, and Stanislaus Rivers. Extremely low winter and spring flows are expected to reduce survival of young fish, however. On the coast, many smaller streams will likely dry up or become too warm to produce young salmon or steelhead.

As the current drought continues, the situation is expected to be even more serious next fall. Unfavorable water temperatures below all major dams and inadequate flows in the Yuba and American Rivers and all of the San Joaquin River tributaries will likely seriously impair King Salmon production. Salmon hatcheries in the Central Valley and on the North Coast are also faced with unfavorable water temperatures, and as a result egg taking may be delayed until late fall 1977. The Department of Fish and Game is developing plans to assist spawning fish, but these efforts may also be hampered by inadequate water flows and undesirable high temperatures.

The major impact of the drought on salmon will not be felt until the salmon progeny enter the sport and commercial fisheries several years from now.

The effect of low water on striped bass and shad reproduction in the Sacramento-San Joaquin Delta is expected to be as great as that occurring during 1976 and perhaps greater since a larger percentage of the remaining outflow will be diverted. Again, the impact on fisheries will not be felt for several years, when juvenile fish produced this year have grown to fishable size.

Another year of drought will depress wild trout populations in many lakes and streams. Numerous smaller streams, particularly those at lower elevations, are expected to dry up. Angling in many streams and reservoirs could suffer for several years. Extensive fingerling plants will be required to restablish these populations.

Reservoirs, already at low levels, will likely be drawn down to or below minimum pool under increased water demand, decreasing fish habitat. As a result, plants of fingerling trout will be reduced generally, and in some waters terminated. The latter include many reservoirs in Modoc and Lassen counties and in the Central Sierra Nevada which have been virtually drained. These include Antelope, Prosser, and Beardsley reservoirs.

Catchable trout will be planted out early in the larger streams and lakes. Plants later in the season will be reallocated largely to natural lakes and those reservoirs with better water conditions.

Most high mountain lakes will not be significantly affected by the drought and some waters such as Lake Tahoe, Whiskeytown Reservoir, Lake Davis, Clear Lake, and reservoirs on the Colorado River will be less affected by the drought and should provide plenty of angling opportunities. Pardee Reservoir, east of Stockton, may not be opened to fishing at all in 1977 because of low water levels.

Wildlife will also continue to be adversely affected by the drought. Many natural and managed waterfowl marshes are expected to dry up. State waterfowl management areas and federal refuges depending on surface waters face severe water delivery reductions, particularly those in the San Joaquin Valley. Many wetlands managed by private duck clubs face similar deficiencies. Higher than normal salinities are expected to be a problem in the Suisun Marsh. State waterfowl management areas with good ground water supplies will be in better shape. Increased concentrations of waterfowl on the remaining wetlands could result in increased disease losses to fowl cholera and botulism.

Upland game birds face another year of poor reproduction, particularly if spring rains are light. Riparian vegetation

along dried up streams will be under great stress. Continued increased domestic grazing will prolong the adverse effects on the summer range of deer. The impact could be accentuated if the fall acorn crop is light.

Not all of California has been subjected to drought. Fish and wildlife resources in Southern California are faring reasonably well as a result of near normal precipitation.

Although the destiny of fish and wildlife is mostly beyond the control of man, under vagaries of the weather, the DFG feels some relief could be realized by: (1) increasing coordination with all water suppliers, especially the U.S. Bureau of Reclamation, to ensure more equitable distribution of water for all needs, including those of fish and wildlife; (2) increasing coordination with federal land management agencies, the U. S. Forest Service and Bureau of Land Management, to have livestock grazing allotments adjusted to better accommodate some wildlife needs; (3) educational programs to inform the public of the harmful effects of the water shortage to fish and wildlife -- this should reduce poaching and disturbance of the resource. An information program to direct the fishing and hunting public to less affected areas where opportunities for good fishing and hunting still exist would be desirable; and (4) although most of the impacts of the current drought on fish and wildlife resources are of a temporary nature, extensive, uncontrolled forest fires could have serious long-term impacts on fisheries, wildlife, watershed, and recreational values. It is important that the public be made aware of the need to be extraordinarily careful with fire this year.

Energy

In January 1977, customers of just one Northern California utility began paying increased bills resulting from drought in 1976 in the aggregate amount of $144 million. Total increased costs may exceed $200 million. With California experiencing a second dry year, the impact on energy will again be significant, because 20 percent of the State's total electrical generating capacity is ordinarily provided by hydroelectric facilities. (Northern California relies on hydropower for one-third of its requirements.) Californians were fortunate that surface reservoirs were reasonably full at the beginning of the drought last year. That is not the case in 1977. Conditions in 1977 are much worse than last year, and a continuation of the low rainfall will result in a 1977 decrease of 63 percent from normal hydroelectric energy production. This means that only about 7 percent of California's electrical energy in 1977 will come from hydro facilities, with 13 percent of the total load shifted to other sources. Replacement with oil will require the use of 33 million barrels at a cost of $495 million -- at current costs (January 1977).

Compounding the impact of hydroelectric energy shortage is the fact that decreased storage in reservoirs used for irrigation has precipitated an increase in the amount of agricultural pumping -- a heavy user of electrical energy. In 1976 pumping increased by 33 percent -- a figure which will undoubtedly be greatly exceeded in 1977.

In 1976, as indicated previously, the economic impact of reduced hydropower from California's reservoirs was eased somewhat by imports from the Pacific Northwest. This year the northwest region is also in the grips of the drought affecting California and its reservoirs are lowering, too. The chances of reducing economic impact in California are tied closely to the fortunes of our sister states to the north. Those fortunes are also bleak. The National Weather Service reports that the State of Oregon is experiencing the driest autumn and winter on record, with Portland averaging about 25 percent of normal precipitation (or about half that of the previous record dry year), with no relief in sight.

Although hydroelectrical energy will be substantially reduced, preliminary review by the Energy Commission indicates that power available from other sources will be sufficient to meet peak demands but with reduced margin. However, PG&E, largest supplier in the State, is expected to experience a total energy shortage which must be made up from other systems.

Forests and Wildlands

A second consecutive year of drought could be devastating in terms of its effects upon vegetation weakened by the stress of low soil moisture in 1976. It is expected that many individual trees and brush will be highly susceptible to being killed by insects or diseases. Other plants simply will not survive a second consecutive growing season with inadequate soil moisture. Many parts of those plants that are able to survive will die back. The result will be an abnormally large addition to the tremendous volume of dead and highly flammable vegetation that is already to be found throughout most of the State's forest, brush, and grass covered wildlands. Potentially then, the 1977 wildland fire season could be one of the most devastating on record in terms of damages from fires to life, property, and natural resources. In addition, the bared earth could result in subsequent damages to on-site and off-site values from eroded soil and flooding during the winter of 1977-78 and possibly for several years thereafter.

Economic Impacts

The Department of Water Resources is making a detailed economic analysis which will not be available until after crop planting decisions are made in March 1977. In the agricultural sector, the Department of Food and Agriculture's preliminary estimates of economic loss in 1977 (billions of dollars) are:

Economic Sector	Pessimistic	Most Likely	Optimistic
Crops	$1.6	$0.9	$0.3
Livestock	0.5	0.5	0.5
Total Farm	$2.1	$1.4	$0.8
Total Agriculture - Related Loss	$6.3	$4.1	$2.4

Although the loss to California agriculture is one of the largest expected as a result of the drought, significant losses are expected in other areas, also, including the energy field and recreational industry.

WHAT MUST BE DONE NOW IN 1977

This second consecutive dry winter requires emergency measures more stringent and effective than those employed in 1976. Continuation of the drought through 1977 is certain. It is important, therefore, that plans to cope with the drought be immediately implemented to get maximum benefit from present water supplies.

Because of the seriousness of the situation, Governor Brown, at a December 31, 1976, press conference, outlined an initial series of actions to combat the drought.

(1) Drought Information Center

The Center, located in Room 1617-16 of the Resources Building, 1416 Ninth Street, Sacramento, will oversee state agency water conservation efforts. It will also issue regular reports on drought conditions and provide information about drought relief programs to farmers, hard-hit communities, and members of the press and public. The Center may be reached in Sacramento by phone, 916-445-1835, during normal working hours. An answering service will take messages at all other times so that 24-hour service is provided. In addition, the district offices of the Department of Water Resources (see Figure 17) and the offices of the Regional Water Quality Control Boards (see Figure 18) will also provide weekly reports on drought conditions and information about drought relief programs. Their telephone numbers are shown on Figures 17 and 18.

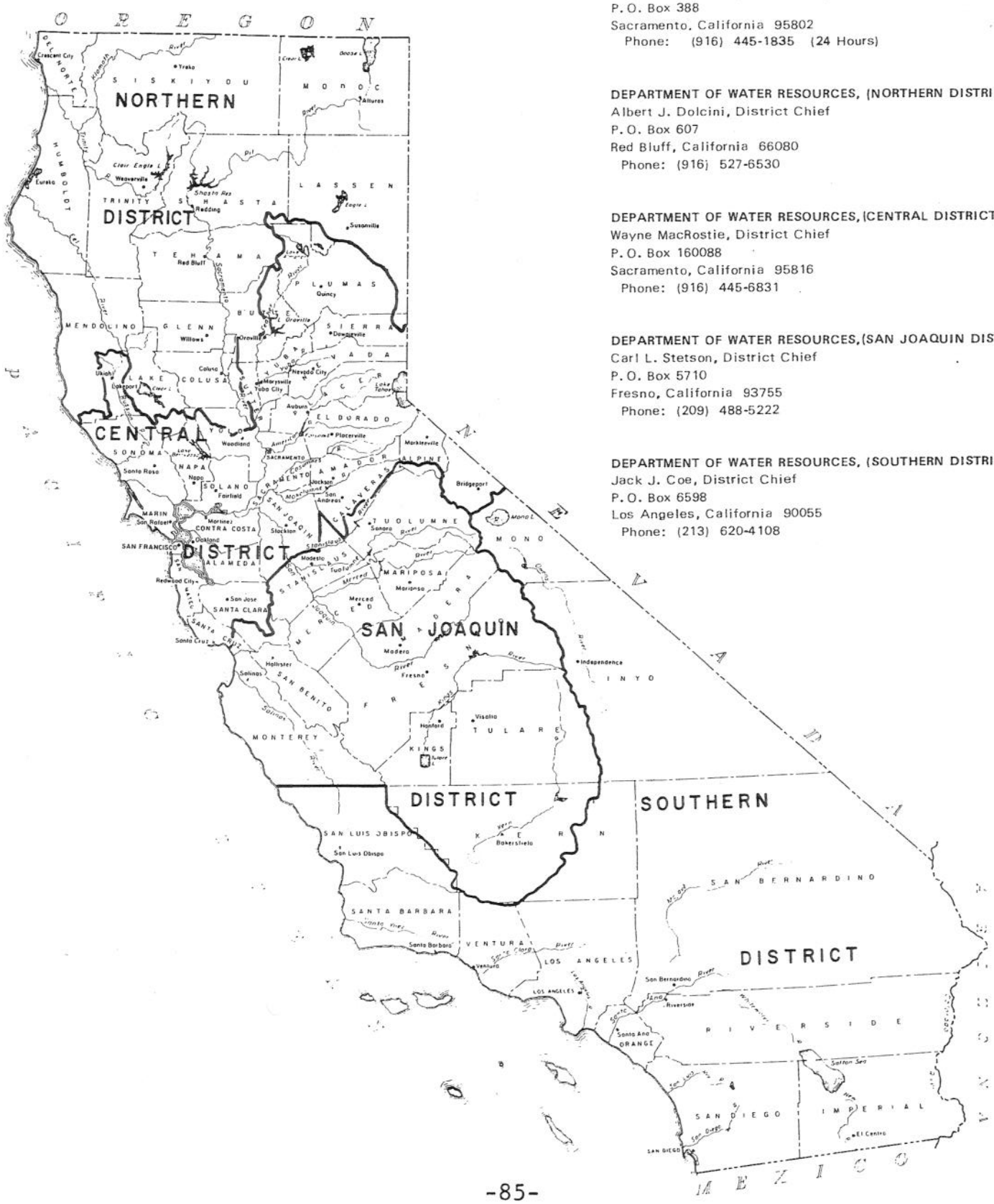
(2) Drought Contingency Plans

The State is requesting development of specific drought contingency plans, including rationing, by local water agencies. On December 31, 1976, a number of California communities were advised to prepare for rationing pursuant to provisions of the Water Code, Sections 350-358 (see Appendix A). Additional communities were subsequently advised, and on February 11, 1977, Governor Brown requested water agencies in the State (over 1,000 in number) to provide details of their drought contingency plans. The responses are being reviewed for adequacy and for purposes of determining what additional steps must be taken to deal with the unprecedented drought.

The experiences of 1976 and 1977 have again brought home to Californians the necessity of identifying our true needs and getting an early and accurate assessment of resources available. This is especially important for 1977 and for 1978 because we begin the period with nearly emptied pockets. Table 11 shows water in storage as of February 1, 1976, in 158 reservoirs owned and/or operated by a number of water supply agencies. Comparison with normal annual demand (not shown) makes it clear that, in

FIGURE 17

DEPARTMENT OF WATER RESOURCES DROUGHT INFORMATION OFFICES



DROUGHT INFORMATION CENTER

DEPARTMENT OF WATER RESOURCES, (HEADQUARTERS)
James U. McDaniel, Chief Drought Information Center
P. O. Box 388
Sacramento, California 95802
Phone: (916) 445-1835 (24 Hours)

DEPARTMENT OF WATER RESOURCES, (NORTHERN DISTRICT)
Albert J. Dolcini, District Chief
P. O. Box 607
Red Bluff, California 66080
Phone: (916) 527-6530

DEPARTMENT OF WATER RESOURCES, (CENTRAL DISTRICT)
Wayne MacRostie, District Chief
P. O. Box 160088
Sacramento, California 95816
Phone: (916) 445-6831

DEPARTMENT OF WATER RESOURCES, (SAN JOAQUIN DISTRICT)
Carl L. Stetson, District Chief
P. O. Box 5710
Fresno, California 93755
Phone: (209) 488-5222

DEPARTMENT OF WATER RESOURCES, (SOUTHERN DISTRICT)
Jack J. Coe, District Chief
P. O. Box 6598
Los Angeles, California 90055
Phone: (213) 620-4108

FIGURE 18

WATER RESOURCES CONTROL BOARD AND REGIONAL WATER QUALITY CONTROL BOARDS OFFICES (CONTACT FOR DROUGHT INFORMATION)

STATE WATER RESOURCES CONTROL BOARD
P. O. Box 100, Sacramento, California 95801
Phone: (916) 322-3737

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

NORTH COAST REGION (1)
1000 Coddingtown Center
Santa Rosa, California 95401
Phone: (707) 545-2620

SAN FRANCISCO BAY REGION (2)
1111 Jackson Street, Room 6040
Oakland, California 94607
Phone: (415) 464-1255

CENTRAL COAST REGION (3)
1122—A Laurel Lane
San Luis Obispo, California 93401
Phone: (805) 549-3147

LOS ANGELES REGION (4)
107 South Broadway, Room 4027
Los Angeles, California 90012
Phone: (213) 620-4460

CENTRAL VALLEY REGION (5)
3201 S Street
Sacramento, California 95816
Phone: (916) 445-0270

FRESNO BRANCH OFFICE
3374 East Shields Avenue
Fresno, California 93726
Phone: (209) 488-5116

REDDING BRANCH OFFICE
1815 Sacramento Street
Redding, California 96001
Phone: (916) 442-6376

LAHONTAN REGION (6)
2092 Lake Tahoe Boulevard
P. O. Box 14367
South Lake Tahoe, California 95702
Phone: (916) 544-3481

BISHOP BRANCH OFFICE
633 North Main Street
Bishop, California 93514
Phone: (714) 873-7111

COLORADO RIVER BASIN REGION (7)
73-271 Highway 111, Suite 21
Palm Desert, California 92260
Phone: (714) 346-7491

SANTA ANA REGION (8)
6833 Indiana Avenue, Suite 1
Riverside, California 92506
Phone: (714) 684-9330

SAN DIEGO REGION (9)
6154 Mission Gorge Road, Suite 205
San Diego, California 92120
Phone: (714) 286-5114

Table 11

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
USBR (Ore)	Upper Klamath	584.0	328.7	56	96
USBR	Clear Lake	526.8	223.2	42	79
USBR (Ore)	Gerber	94.3	35.0	37	65
Montague WCD	Dwinnell	72.0	13.0	18	39
Humboldt MWD	Ruth	51.8	16.9	33	34
PG&E	Pillsbury[1/]	93.7	9.2	10	16
U.S. Corps of Engineers	Mendocino	122.5	52.8	43	76
City of Napa	L. Hennessy	30.0	16.4	55	56
Marin MWD	Nicasio	22.5	0.5	2	2
	Kent	16.5	1.4	8	9
	Alpine	9.2	5.5	60	74
East Bay MUD	San Pablo	43.2	18.8	44	65
	U. San Leandro	41.4	17.8	43	57
	Chabot	12.6	2.9	23	27
	Briones	67.5	58.7	87	124
	Pardee	210.0	68.6	33	36
	Camanche	431.5	168.0	39	60
City of San Francisco	San Antonio	50.5	24.8	49	80
	Calaveras	100.0	29.6	30	46
	San Andreas	18.5	16.6	90	102
	Crystal Springs	54.0	42.7	79	87
	Hetch-Hetchy	360.4	32.3	9	23
	Cherry Lake	268.8	69.7	26	68
	L. Eleanor	27.8	-0-	-0-	-0-
DWR	Del Valle	77.1	24.9	32	85
Santa Clara Co. FCWD	Coyote	24.5	5.7	23	31
	Anderson	91.3	26.5	29	47
	Lexington	21.4	-0-	-0-	-0-

[1/] Principal supply to Mendocino and Sonoma Counties after diversion into the Russian River.

* 1,000 acre-feet equal 1.233 cubic hectometres.

Table 11 (Continued)

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
San Jose Water Works	Austrian	6.2	0.7	11	19
U. S. Corps of Engineers	Salinas	23.4	11.8	50	51
Monterey Co. FCWCD	San Antonio	350.0	228.4	65	105
	Nacimiento	350.0	44.3	13	24
San Luis Obispo Co. FCWCD	Lopez	51.0	40.7	80	Unknown
City of Santa Barbara	Gibraltar	10.0	4.6	46	48
USBR	Cachuma	204.9	139.0	68	77
	Casitas	254.0	199.7	79	106
State of Calif.	Whale Rock	40.0	32.4	81	101
United WCD	L. Piru	101.2	10.3	10	28
DWR	Pyramid	171.2	167.5	98	102
	Castaic	323.7	136.8	42	65
	Perris	131.5	84.2	64	87
Ventura Co. FCD	Matilija	2.5	0.6	24	56
Los Angeles Co. FCD	Cogswell	10.4	2.0	19	71
	San Gabriel	44.6	4.4	10	66
Bear Valley MWC	Bear Valley	72.4	36.8	51	68
MWD	L. Mathews	182.0	61.8	34	43
Lake Hemet MWD	L. Hemet	14.0	5.7	41	74
Temescal WC	Railroad Canyon	12.0	8.2	68	113
Serrano Corp ID Irvine Co.	Santiago	25.0	7.1	28	57
Rancho California	Vail	51.0	17.5	34	86
Vista ID	Henshaw	203.6	4.0	2	36

*1,000 acre-feet equal 1.233 cubic hectometres.

Table 11 (Continued)

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
City of San Diego	L. Hodges	33.6	4.8	14	131
	Sutherland	29.0	2.6	9	83
	San Vicente	90.2	62.3	69	92
	El Capitan	116.5	14.7	13	63
	Murray	6.1	3.5	57	101
	Lower Otay	56.3	7.5	13	79
	Morena	50.2	2.3	4	81
	Barrett	44.9	0.9	2	44
	Miramar	7.3	6.4	88	107
Helix WD	Cuyamaca	11.6	0.8	7	70
	L. Jennings	10.5	7.9	75	105
Cal. American WC	L. Loveland	27.7	16.9	61	148
	Sweetwater	27.7	7.0	25	206
USBR	Shasta	4552.0	1532.9	34	45
	Keswick	23.8	22.3	94	102
	Whiskeytown	241.1	202.0	84	96
	Lewiston	14.6	13.7	94	102
	Clair Engle	2448.0	1158.6	47	57
PG&E	McCloud	35.3	18.1	51	71
	Iron Canyon	24.3	8.8	36	172
	L. Britton	40.6	35.0	86	460
	Pit No. 6	15.7	14.3	91	99
	Pit No. 7	34.0	33.8	99	107
	L. Almanor	1308.0	599.9	46	81
	Mtn. Mdws.	24.8	-0-	-0-	-0-
	Butte Valley	49.8	47.5	95	122
	Bucks Lake	103.0	43.7	42	76
	Spaulding	137.4	33.2	24	77
	Caples Lake	21.6	5.9	27	76
	Lower Bear	48.5	5.1	11	42
	Salt Springs	139.4	4.9	4	16
	Relief	15.1	-0-	-0-	-0-
	Strawberry	18.6	6.5	35	111
	Crane Valley	45.4	19.2	42	85
	Courtright	123.3	34.7	28	86
	Wishon	128.0	49.0	38	146
DWR	Antelope	21.6	1.3	6	6
	Frenchman	51.0	14.5	28	33
	L. Davis	83.0	58.7	71	81

*1,000 acre-feet equal 1.233 cubic hectometres.

Table 11 (Continued)

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
DWR (cont.)	Thermalito	82.3	41.4	50	80
	Oroville	3537.6	1605.9	45	67
Oroville-Wyandotte	Ltl. Grass Valley	93.0	44.6	48	71
	Sly Cr.	65.1	9.7	15	32
Yuba Co. WA	Bullards Bar	961.3	269.7	28	54
Nevada ID	Jackson Mdws.	68.5	3.2	5	9
	Bowman Lake	68.0	24.8	36	57
	French Lake	12.5	-0-	-0-	-0-
	Scotts Flat	49.0	17.7	36	40
	Rollins	66.0	7.9	12	12
Calif. Debris Commission	Englebright	70.0	61.6	88	101
South Sutter WD	Camp Far West	103.0	9.0	9	8
Browns Valley ID	Virginia Ranch	57.0	14.5	25	Unknown
Placer Co. WA	French Meadows	133.7	40.0	30	58
	Hell Hole	208.4	84.9	41	73
Sacramento MUD	Slab Creek	16.6	15.9	96	115
	Loon Lake	76.5	4.8	6	15
	Union Valley	271.0	19.5	7	13
	Ice House	46.0	4.7	10	20
USBR	Folsom	1010.3	292.0	29	49
	L. Natomas	8.8	8.7	99	104
Orland Water Users Assn.	East Park	51.0	4.8	10	12
	Stony Gorge	50.1	9.7	19	26
U. S. Corps of Engineers	Black Butte	160.0	11.8	7	23
Yolo Co. FCWCD	Clear Lake	420.0	-0-	-0-	-0-
	Indian Valley	300.0	-0-	-0-	-0-
USBR	L. Berryessa	1600.0	997.2	62	65
	Jenkinson Lake	41.0	7.7	19	22

*1,000 acre-feet equal 1.233 cubic hectometres.

Table 11 (Continued)

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
U. S. Corps of Engineers	New Hogan	325.0	68.1	21	41
Oakdale & So. San Joaquin IDs	Donnells	64.5	10.6	16	67
	Beardsley	97.5	4.0	4	7
	Melones	112.6	3.5	3	6
	Tulloch	68.4	19.2	28	40
Turlock & Modesto IDs	Don Pedro	2030.0	619.2	31	71
Turlock ID	Turlock Lake	49.0	31.6	65	94
Modesto ID	Modesto	29.0	24.5	85	149
Merced ID	L. McClure	1026.0	212.8	21	36
So. Cal. Edison	Florence Lake	64.4	0.3	1	35
	T. A. Edison	125.0	10.4	8	21
	Mammoth Pool	122.7	16.1	13	39
	Huntington Lake	88.8	45.3	51	69
	Shaver Lake	135.3	27.6	20	69
	Redinger Lake	35.0	25.0	72	102
USBR-DWR	San Luis	2038.8	1100.3	54	59
	O'Neill Forebay	56.5	52.6	93	113
USBR	Los Banos	34.5	18.1	52	98
	Millerton	520.6	252.0	48	65
U. S. Corps of Engineers	Pine Flat	1001.5	266.3	27	44
	Isabella	570.0	66.6	12	34
	Terminus	150.0	13.7	9	56
	Success	82.0	10.8	13	45
USBR	Stampede	226.5	42.5	19	32
	Prosser Creek	29.8	0.1	-0-	1
	L. Tahoe	744.6	164.0	22	29
	Boca	41.1	24.3	59	111
Walker River ID	Bridgeport	42.5	10.7	25	33

*1,000 acre-feet equal 1.233 cubic hectometres.

Table 11 (Continued)

RESERVOIR STORAGE AS OF FEBRUARY 1, 1977

Owner or User	Reservoir	Capacity (1000 AF)*	Storage (1000 AF)*	Percent of Capacity	Percent of Normal
So. Cal. Edison	Saddlebag Lake	11.1	3.2	29	69
	Gem Lake	17.6	7.0	40	107
	South Lake	13.4	3.8	28	79
City of Los Angeles	Grant Lake	47.5	11.2	24	37
	L. Crowley	183.5	45.1	25	32
	Tinemaha	16.4	6.2	38	88
	Haiwee	58.5	40.4	69	94
DWR	L. Silverwood	78.0	48.8	63	81
USBR	L. Powell**	25,002.0	18,017.0	72	144
	L. Mead**	26,102.0	21,988.0	84	124
	L. Mohave**	1810.0	1676.1	93	102
	L. Havasu**	619.0	542.7	88	100

* 1,000 acre-feet equal 1.233 cubic hectometres.

**Interstate Reservoir used jointly by California and Adjacent States.

most cases, existing carryover storage is insufficient to meet even the 1977 demand without substantial replenishment (which is highly unlikely) during the remainder of this spring. Tables 7 and 8 list water supply conditions, as of February 1977, for selected urban and agricultural areas. Of the urban areas listed, a number are already practicing rationing; others are actively considering its initiation; and still others will be forced to face the fact that it is necessary before the summer of 1977.

Close monitoring of water supplies and a conservative but a realistic forecast of what will be available are important elements of planning. All communities must establish their priorities for water use and develop plans to cope with shortages, including emergency regulations (rationing plans). Neighboring communities or areas of use must establish working coordination to explore possibilities for water exchange through physical means such as cross connections or by other means such as temporary reassignment of abundant supplies of water to areas of shortage.

The State Water Resources Control Board is contacting holders of water right entitlements, and users of substantial amounts of water under claim of riparian or pre-1914 rights, in drought-critical areas. Each holder or user will be notified of the outlook for water availability during 1977, updated periodically, for precipitation conditions in each watershed, and will be advised to prepare to cope with curtailed supplies by developing drought emergency plans. For example, irrigators will be advised to plant crops with low water demand where possible (e.g., safflower instead of rice). Municipalities have available a number of methods for reducing water usage.

Each water rights holder or user will be provided information and guidelines for water conservation practices. In addition, they will be notified of the Board's intent to determine and enforce priorities of existing rights if water supply is inadequate even with water conservation measures. Where necessary, water conservation measures will be enforced in order to assure an equitable sharing of available water.

The State Office of Emergency Services sent a letter to all California water utilities, dated December 30, 1976 (see Appendix B), suggesting that all communities prepare for unfavorable levels of precipitation by initiating water delivery stretch-out programs (i.e., conservation) without delay. A number of agencies have already taken steps to initiate these programs. Notable examples are the East Bay Municipal Utility District and the City of San Francisco, both serving the large metropolitan area around San Francisco Bay, the MWD of Southern California, and the California-American Water Company serving the Monterey Peninsula. All of these, except for San Francisco, have initiated

mandatory controls for water usage. Already mentioned is the Marin MWD's stringent program for enforced rationing. A continuation of dry conditions must bring an expansion of mandatory controls, if water supplies for 1978 are not to be jeopardized.

The Department of Water Resources has prepared a model rationing ordinance (available from DWR offices) which communities with critical water shortages can implement to restrict the use of water. This ordinance, or one similar, should be adopted now by communities which are very likely to have critical water shortages this spring, summer, and fall.

(3) Water Conservation

State agencies, with the assistance of the University of California, have prepared detailed guidelines on domestic and agricultural water conservation. The Department of Water Resources and the State Water Resources Control Board will distribute the guidelines and will seek voluntary compliance with the recommended conservation measures. They will also identify wasteful uses of water and, where persuasion efforts for correction fail, bring legal action to curb waste and unreasonable use, pursuant to California Water Code, Section 275 and the constitutional mandate of Article X, Section 2, of the California Constitution (see Appendix C).

As a first step in this process, a joint public hearing involving the Board and the California Water Commission (CWC) was held January 31, 1977, to receive evidence and comments on a "Water Conservation Policy", "Water Conservation Principles, and Guidelines", and "Concepts of Reasonable and Unreasonable Use of Water". In its next scheduled meeting on March 4, 1977, the CWC will consider them. The SWRCB will consider them at its next meeting on March 17, 1977.

In addition, all state agencies are undertaking water conservation programs, with early results to be reported in March 1977.

Guidelines for water conservation will adhere to a policy that defines how we will use less water while accomplishing all reasonable purposes and saving energy. Elements of the policy include:

- Setting standards of reasonable use of water under which the State will take legal action as necessary.
- Requesting plans and implementation of water conservation by local agencies.

- Extending State help to local agencies in implementing conservation through advisory services and technical advice.

- Requiring conservation measures to stretch available water supplies before committing new supplies.

- Providing for building conservation into all State water plans and actions over which we have control or influence.

- Providing for public education activities to induce a conservation ethic.

- Providing for setting up water conservation demonstration projects to show how to save water, both agricultural and urban.

In implementing the above policy, users will be asked to consider the following specific courses of action:

1. All Users

   (a) Substitution of alternative supplies, if available. Users who have both surface and ground water supplies should increase their reliance upon their ground water sources, unless it can be definitely shown that the surface water being taken will have no significant effect on other beneficial users, or that switching to ground water will cause permanent damage.

   (b) A concerted program to reduce losses due to leaks, inefficient methods of application, etc.

2. Municipal Users

   (a) Elimination or drastic reduction of nonessential uses, such as watering golf courses, sports fields, public parks, etc.

   (b) Limiting watering of residential lawns to minimal fixed hours, using hand-held hoses only.

   (c) Installation of water-saving devices, such as toilet and shower kits.

   (d) Prohibiting swimming pool filling or refilling.

   (e) Prohibiting car washing, street washing, or driveway and sidewalk hosing.

3. Individual Domestic Users

(a) Elimination of watering for dust control, lawn watering, car washing, etc.

(b) Installation of water-saving devices.

4. Agricultural Users

(a) Reduction of total irrigated acreage to a fixed percent of that served in past years.

(b) Substitution of low water demand for high demand crops.

(c) Irrigation of most productive land only.

(d) Special installations to recapture and reuse return flows from irrigated fields.

(e) Reduction of evaporative losses.

Throughout the State there exists considerable potential for water savings. As indicated previously, experience this year shows that water can be conserved if users are sufficiently motivated. In the Central Valley and similar inland areas, water is often reused beneficially several times before eventually escaping to the sea. This is not true of coastal communities. Savings achieved in coastal metropolitan locations or those urban centers situated relatively far downstream have greater importance because the chance of reuse has diminished. It is in these heavily populated areas, such as the Los Angeles, San Francisco Bay, and Sacramento metropolitan areas, where greater conservation efforts should be concentrated. Examples of current water usage in California cities are shown in Appendix I.

The current drought has renewed interest in metering as an instrument for achieving water conservation. History shows that metering, coupled with an appropriate rate structure, is a most effective means to promote water savings. In a 1974 study for the SWRCB, it was concluded that metered cities averaged only 185 gallons per capita daily use, whereas unmetered cities averaged 330 gallons. This conclusion was based on analysis of 1970 data from California cities. It was estimated that water use could be reduced by 332,000 acre-feet (410 cubic hectometres) statewide. It is clear that as California's water supply becomes more fully needed by nonwasteful beneficial uses, there will be increased need to determine actual use. Metering is expected to provide the means, and those urban areas currently without effective measuring tools should take steps now to gain them.

To determine the best methods of obtaining voluntary use of water conservation devices in the bathrooms of existing

homes, DWR has planned a series of test programs in various parts of the State, which have as their purpose to learn the acceptance of various kinds of devices and to determine how willing Californians are to use them in both critical and noncritical water supply situations. Use of toilet tank "dams" to reduce the amount of water used by a standard toilet and installation of shower flow restrictors are estimated to save from 19 to 30 percent of the water used inside a home --- as much as 48,000 gallons per year for the average family.

The State Energy Commission estimates that, if 100 percent installation of these devices were to be accomplished in Southern California, annual electrical energy savings of 0.9 billion Kwh would be derived, based on lowered heating and water processing requirements. In addition, 16.5 billion cubic feet (0.47 billion cubic metres) of natural gas would be saved. Annual dollar savings would amount to $67,500,000. Based on the number of housing units in the area (4,580,000), a $14.74 investment per unit would be repaid in just one year from energy savings alone.

A model garden is planned for the Capitol area to determine the extent that water conservation is feasible in the normal outdoor residential uses. It is expected to provide information on water conservation techniques useful in landscaping, encourage use of drought resistant plants, demonstrate water-saving practices, and provide research data on plants' water demand. The project is the result of interest by several nursery, horticultural, utility, and environmental groups. The State Office of Appropriate Technology and the DWR are coordinators, and the Department of Forestry and the Soil Conservation Service have donated plants. Some tools, drip irrigation equipment, design advice, and labor are being donated by other interested groups.

In May 1976, the Department released Bulletin No. 198, "Water Conservation in California"[1/]. Bulletin No. 198 contains a number of suggested conservation practices which will be particularly timely to alleviate the effects of the drought through 1977. For convenient use by individuals the Department has prepared a two-page information bulletin titled "Hints for Water Conservation". Copies are available at all drought information offices and in Appendix D. Other DWR information bulletins available are "Water Pricing" as a means of reducing urban water use; "Toilet Damming Devices", "Toilet Flush Adapters", "Low Flush Toilets", "Faucet Flow Controls", "Automatic Dishwashers", "Low Volume Shower Heads and Adapters", and "Automatic Clothes Washers",

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[1/] Available on request from the Department of Water Resources, P. O. Box 388, Sacramento, California 95802.

all listing make, model, manufacturer, and water usage specifications for low water use facilities. The bulletins are included as Appendix E. Information on low usage landscaping plants is available from utilities and horticultural societies listed on another DWR information bulletin, "Home Landscaping", also available at all drought information centers (and included in Appendix E).

(4) Water Exchanges

The State will encourage and, where appropriate, enter into water exchange contracts to reallocate water from areas with sufficient supply to water-short areas.

Many areas have several sources available to them. Even though there are many technical, institutional, legal, and financial problems involved, we believe it is possible, at least on a short-term basis, for an area to increase its use of water from one source and release water it would otherwise receive from another source so that water can be used by areas facing a greater shortage.

The extensive facilities of the SWP offer opportunities for interregional exchanges or purchases. Local facilities can also be used for intraregional exchanges. If necessary and desirable, exchanges could include arrangements to replace water in a subsequent wet year. Financial considerations will likely be necessary in most instances. Full exploration of some exchanges may reveal physical or operational limitations not previously known.

The February 10, 1977 agreement between the DWR, MWD, EBMUD, USBR, SWRCB, Contra Costa Water District, and Marin Municipal Water District, whereby the Metropolitan Water District (MWD) of Southern California agrees to lessen its consumption of SWP water imported from Northern California serves as a good example of what can be accomplished in this field. The MWD's service area, including Los Angeles and the South Coastal region, is served by the Colorado River Aqueduct and the SWP. It also has significant ground water resources and pumping capacity. In addition, the City of Los Angeles' aqueduct from Owens Valley provides an additional supply to the area. The agreement provides that up to 400,000 acre-feet (490 cubic hectometres) will be made available in 1977 to Northern California users, principally in the Central Valley and San Francisco Bay area.

The Los Angeles Department of Water and Power has pumping and aqueduct capacity to extract greater amounts of ground water from the Owens Valley than the amount now specified in an injunction relating to possible environmental damages due to increased pumping.

Another alternative would be an exchange involving SWP water and ground water pumped from the several ground water basins in the MWD service area. For example, the San Bernardino Valley Municipal Water District overlies a major ground water basin.

Exchanges were made by several agencies in 1976, one of the more notable examples being the transfer of 10,000 acre-feet (12 cubic hectometres) between the MWD and Dudley-Ridge Water District in Kings County. Also in 1976, the Consolidated Irrigation District in Fresno County, sold to others its 1976 entitlement water from the Kings River and operated solely from ground water. Added progress in this direction will help California to remain "one State" in water matters. While we do not underestimate the problems, the example of the electric utilities gives us hope. In that industry, private companies and public utilities maintain their separate identities, but balance a shortage in one service area through generation in another.

Besides the exchanges of MWD water noted previously, other possible sources of additional water and some of the key issues are:

(a) Increased reliance on ground water pumping in the Livermore and Santa Clara Valleys, and southern Alameda County, with as much as possible of the normal South Bay Aqueduct supply going to other SWP contractors. Costs and future replacement water are issues which would need to be worked out.

(b) Reduction of the City of Vallejo's Cache Slough diversion with replacement water delivered from the Solano Project. Costs and recreation around Lake Berryessa would need to be considered.

(c) Use of Lake Hennessey water in the upper Napa Valley. The City of Napa could take additional water from the North Bay Aqueduct. Availability of facilities to convey water to upper Napa Valley and costs are considerations.

(d) Installation of temporary conveyance systems to Marin MWD from San Francisco on the Golden Gate bridge, from East Bay MUD on the Richmond-San Rafael bridge, or transportation by barges across San Francisco Bay. The agreement with MWD, noted earlier, will provide up to 11,000 acre-feet (14 cubic hectometres) to Marin in 1977. Water will be transported through the EBMUD's Mokelumne Aqueduct to the transfer point at Richmond.

(e) Deliveries to the Contra Costa County Water District using an idle barrel of the East Bay MUD's Mokelumne Aqueduct are presently being implemented. The plan envisions installation of pumps to obtain higher quality water at the Aqueduct's crossing at Middle River in the Delta and transporting the water through the Aqueduct to its crossing at Old River, where it will be released to replace lower quality water at the Contra Costa Canal intake.

(f) Deliveries of CVP water to East Bay MUD. The USBR has agreed to provide up to 75,000 acre-feet (92 cubic hectometres) to EBMUD in 1977. Pumps installed at Middle River in the Delta will be used to pump water into the EBMUD's Mokelumne Aqueduct.

(g) Installation of wells and pipeline to pump Salinas Valley ground water to the Monterey Penninsula. Costs and uncertainty of any source of replacement water would need to be worked out quickly to allow construction to begin promptly.

(h) Purchase of irrigation water from areas which have less than a full supply to supplement other partial supplies. High use crops such as rice and pasture might be foregone. Costs, conveyance, water rights, and replacement crops are issues being considered in private negotiations with the State assisting.

(i) Deliveries of SWP water to East Bay MUD, San Francisco WD, or to other San Francisco Bay region users. Connecting facilities, costs, and replacement water are issues to be worked out. As a condition of any such exchange, the State will insist that the area receiving the benefit of an SWP exchange must have underway an effective, mandatory conservation program.

The foregoing possibilities of water exchange or sources will be fully explored; those found feasible and appearing favorable from a statewide perspective will be encouraged.

(5) Emergency Water Supply Loans and Equipment

The State, pursuant to AB 3793 (1976), will continue to make available to small communities 2-1/2 percent loans up to $100,000 for purchase and installation of emergency facilities to maintain community water supplies. The first loan under the program was provided, on February 10, 1977, to the Lime Saddle Community Services District, near Oroville, to finance a new well and pump installation. In addition, the OES is providing emergency water supply equipment (pipes, pumps, storage tanks, chlorinators) to drought-stricken areas.

(6) Extension of Disaster Relief

U. S. Department of Agriculture (USDA) disaster declarations for California counties, which were due to end on January 6, 1977, have been extended for nine months until September 1977 by the Farmers Home Administration (FmHA). This will allow farmers who suffer losses as a result of the drought additional time to make applications for low-interest emergency loans. To date, the FmHA has authorized Emergency Loans in the amount of $703,370 and $10,000,000 in Emergency Livestock Loan Guarantees.

The following 28 counties have been designated drought disaster areas by the USDA:

Alameda	Kings	Riverside	Solano
Amador	Los Angeles	San Benito	Stanislaus
Calaveras	Madera	San Bernardino	Sutter
Colusa	Merced	San Diego	Tehama
Contra Costa	Monterey	San Joaquin	Tulare
Fresno	Napa	San Luis Obispo	Tuolumne
Glenn	Nevada	San Mateo	Yolo

Assistance available to farmers, ranchers, and stockmen as a result of these designations may include emergency livestock feed program; railroad freight rate reductions; emergency conservation measures; adjustments in regular programs for wheat, feed grain, and cotton growers; and low-interest emergency loans.

Assistance available to rural towns and communities may include "Community Facility Loans" to construct community water systems and "Soil and Water Conservation Loans" to finance land and water development measures.

A time extension for obtaining emergency loans has been extended as follows:

FmHA - physical loss loans	2/28/77
FmHA - production loss loans	9/29/77

At Governor Brown's request, the President, on January 20, 1977, declared an emergency in the State of California covering the following 23 counties:

Amador	Lassen	Plumas	Tehama
Butte	Mariposa	Sacramento	Trinity
Calaveras	Mendocino	San Joaquin	Tuolumne
Colusa	Merced	Shasta	Yolo
El Dorado	Nevada	Stanislaus	Yuba
Glenn	Placer	Sutter	

Assistance available as a result of the President's emergency declaration follows:

1. Emergency Livestock Feed Assistance Program administered by the Agricultural Stabilization and Conservation Service (ASCS). Up to 50 percent of the cost of feed determined to be eligible by ASCS not to exceed 2¢ per pound grain equivalent of such eligible feed purchases or 10 pounds and 20¢ per animal unit.

2. Farmers Home Administration Emergency Loan Program which provides qualifying farmers and ranchers with loans at 5 percent for up to seven years repayment period for losses sustained due to the drought, and 8 percent loans for maintaining agricultural operations through the current year.

In addition, the Small Business Administration (SBA) announced on February 10, that businesses affected by drought in the 23 counties listed above will be eligible for low interest loans.

On February 2, 1977, the President approved the addition of the following 14 counties to his January 20 declaration:

Alameda	Marin	Sierra
Contra Costa	Napa	Solano
Fresno	San Benito	Sonoma
Inyo	San Mateo	Tulare
Madera	Santa Clara	

The 14 counties listed above are also being considered for eligibility under the SBA program allowing low interest loans to businesses affected by drought.

On February 17, under authority delegated to him, the Administrator of the SBA declared the following 9 counties disaster areas. The declaration will make available economic injury low-interest loans to resort owners and business people suffering losses due to the lack of snow and water:

Calaveras	Napa	Shasta
El Dorado	Plumas	Tehama
Lassen	San Joaquin	Tuolumne

The 24 contiguous counties are also eligible:

Alameda	Lake	Mono	Solano
Alpine	Madera	Placer	Sonora
Amador	Mariposa	Sacramento	Stanislaus
Butte	Mendocino	Santa Clara	Trinity
Contra Costa	Merced	Sierra	Yolo
Glenn	Modoc	Siskiyou	Yuba

(7) Commission for Revising California Water Law

Governor Brown is establishing a special commission to review and recommend changes in present law governing water rights. Existing California water rights law contributes to wasteful use. The basic water rights concepts have undergone little change since the mid-Nineteenth Century and have become, in some respects, an obstacle to optimal management of the State's scarce water resources.

During years of plenty we tend to forget that all estimates of project yields - whether they be state, federal, or local - are based on expected repetition of dry years. The current dry period has shown an alternative which should be considered -- a reordering of priorities, coupled with a reexamination of shortage formulas in water service contracts.

It has always been assumed that municipalities could not accept shortages, but that agriculture could. Most agencies subscribe to the concept that domestic use has a higher priority than agricultural use. In fact, the concept has gained expression as state policy in the California Water Code. It is time to reconsider this order of priority. It is time that both sets of users identify the nonessential uses and do their part in accepting less when less is all that is available. We may learn from the experience of the British, until recently heavily impacted by 18 months of drought. Their Drought Minister, in announcing in August 1976 that a national drought emergency advisory committee was being formed, stated that henceforth water consumption was to be halved and that priority of water use was: (1) industry and agriculture, (2) safety and health, and (3) at the bottom, domestic users. In England this order of priority has been generally accepted. It merits attention in California.

Other Actions

The Departments of Health and Water Resources are working together to implement the "Safe Drinking Water" Bond Act passed by the electorate last June to provide assistance to agencies desiring to upgrade their water systems. A priority list of 84 agencies was adopted at a public hearing November 20, 1976 and three applications for assistance have already been received. The first low-cost loans under the Act may be available as soon as March 1977. Reconstruction of deficient systems is expected to provide many communities with the capability of coping successfully with drought impact.

The State Water Resources Control Board has announced an additional program to expedite its formal actions in responding to drought emergency, including the process for obtaining temporary urgency water rights permits or for changes in points of diversion, places of use, and purposes of use under existing

entitlements. The Water Code provides for issuance by the SWRCB of special permits to appropriate water under circumstances where an applicant has an urgent but only temporary need for the water, not to exceed six months, with one renewal for the same period available (Water Code Section 1425 et seq.). It is possible that some water users facing loss or substantial diminution of water from a source to which they hold a water right, may be physically able to obtain water on a temporary basis from some other source. In such a case, these urgency permit procedures are available to authorize the temporary appropriation. The SWRCB will institute procedures to streamline the issuance procedure. If necessary, weekly hearing sessions will be scheduled in order to provide a ready decision-making process to deal with emergencies. The SWRCB adopted an emergency regulation on January 20, 1977, expediting the hearing process. A copy of the order is included in Appendix F.

The SWRCB will initiate a more comprehensive program to determine and enforce priorities of existing rights. It will determine the level of availability of water as follows: (1) Obtain or construct water supply curves for significant streams; (2) Obtain demand curves for the various areas. The demand curve is composed of the sum of the demands under riparian, pre-1914 appropriative, and post-1914 appropriative rights. Whenever the demand curve lies below the supply curve, water is available for all rights. As soon as the supply curve dips below the demand curve, exercise of water rights must be curtailed; (3) Estimate demands of riparian, pre-1914 appropriative rights and post-1914 appropriative rights on the various streams and contact the owners of rights for which no water is available.

The State Energy Commission has explored several potential solutions to the potential energy capacity and shortage problems. In a January 26, 1977, resolution, it urged PG&E and the Los Angeles Department of Water and Power (LADWP) to enter into negotiations whereby PG&E would lease LADWP's idle Scattergood Plant and, using Northern California natural gas, generate electrical energy so as to provide reliable additional capacity. Negotiations are currently underway.

With respect to the energy shortage problem, the Energy Commission in its hearing of February 9, 1977, requested information from utilities, particularly Southern California Edison, to give more exact projections of energy needs and supplies. The information will be used to determine if a shortfall in total energy will occur. Utility responses are scheduled to be completed by March 9, 1977.

If the responses indicate that there may be a shortage, the Commission suggests that consumers be reminded to conserve by such actions as:

(1) Adjusting thermostats of air conditioners, heating systems, and water heaters.

(2) Keeping windows, doors, and fireplace dampers closed.

(3) Opening windows at night in the summer to aid cooling.

(4) Waiting until off-peak hours to do washing, drying, and cooking.

(5) Discontinuing use of clothes driers.

(6) Discontinuing use of decorative lighting and similar uses.

Energy utilities are already making plans to cope with shortages expected in 1977. The PG&E has announced an immediate reduction of its service level voltage to residential and commercial customers by about 3 percent (with further cuts to 5 percent being considered) in a move estimated to save one billion barrels of oil annually. The reduction in voltage will have no noticable effect on customers.

The Department of Forestry has developed a plan of augmented fire protection which will help mitigate the expected damaging effects of the 1977 wildland fire season. Even if this plan of fire prevention and suppression is implemented, however, it will not be enough to fully meet the probable onslaught of wildland fires. Every person who lives, works, or relaxes in the State's rural and forested areas must help to prevent fires from starting and must take measures now to protect their exposed homes and other property from the possibility of encroaching wildland fires. They should check with local ranger stations or fire departments to determine what can be done to reduce or eliminate the hazard of flammable vegetation adjacent to their property.

The State Department of Food and Agriculture has recommended procedural changes to streamline programs for assisting agricultural victims of natural disasters. They include: (1) establishing temporary field offices in times of emergency, (2) simplifying loan applications and approval process, (3) basing loans on anticipated loss to expedite processing, and (4) giving more attention to those victims most subject to total loss. The Department also suggests: (1) legislation to provide for state assistance in the form of short-term loans to cover the period of delay before federal assistance arrives, and (2) revising state policy and law with a view to making state equipment and services available to individuals adjudged in need.

In its Assembly Concurrent Resolution No. 16 (see Appendix H), the California State Assembly has requested that the Department of Water Resources provide technical assistance to

public agencies in evaluating water supplies and demands and in implementing water conservation programs. This work is under way.

The DWR, in cooperation with federal and state agencies, is establishing a clearinghouse of information regarding the availability of water supply equipment including pumps and generators, water trucks, pipe and treatment facilities.

In connection with its operation of the SWP, the DWR is considering the installation of rock barriers in the Delta. This action, if undertaken, would be similar to the successful operation at Sutter Slough in 1976, and is expected to make more water available in 1977 while maintaining Delta water quality.

State and federal agencies are marshalling forces to provide emergency well drilling assistance to public agencies using equipment owned and/or operated by state and federal offices.

State and federal agencies stand ready to provide assistance in constructing temporary facilities for emergency water supply. Details of financing will need to be worked out.

The ASCS' ongoing conservation programs, such as those providing assistance in constructing stock ponds, may serve as an additional avenue of help during the drought.

The DWR is ready to assist in water exchange agreements as may be needed to assure adequate water supply for all.

In cooperation with the University of California Extension Service, State Department of Food and Agriculture, and federal agencies the DWR is setting up an advisory group on irrigation practices which will cut water losses, especially to evapotranspiration.

Related to this action, the Department of Transportation has begun a program of cutting back on water needs and uses by severely pruning its highway landscaping (trees and shrubbery) and by installing and resetting automatic timers to cut down on sprinkler usage.

The Governor's staff has met with federal officials in Washington, D.C., to assure that all possible federal assistance will be made available.

The DWR will take steps to make state equipment or other services temporarily available, on an emergency basis, to victims of drought. Meanwhile, there are actions which may be taken by individuals. Farmers and their suppliers must come to an early understanding of the minimum amount of water which will be available so that planting decisions may be made without fear that lack of water will force crop abandonment. Ground water storage

of runoff must be accelerated, where possible. Systems subject to waste and leakage must be improved. Where appropriate and possible, water must be reused.

Farmers and domestic owners who need to get their wells and pumps in order are already encountering unanticipated expense or delay in obtaining service. In some cases, service may be delayed as long as 16 weeks because of delivery time for transformers. Plans for reconstruction or drilling new wells must be accelerated.

In other actions, state and federal agencies have augmented the number of "hotlines" (telephone contacts for information) to provide additional information on drought conditions and on assistance programs. Some of the office numbers and information now available include:

Drought Information Center (SACRAMENTO, 24 HOURS)	(916)445-1835
DWR-Northern District (Red Bluff)	(916)527-6530
DWR-Central District (Sacramento)	(916)322-6220
DWR-San Joaquin District (Fresno)	(209)488-5041
DWR-Southern District (Los Angeles)	(213)620-4203
State Water Resources Control Board (Sacramento)	(916)322-3737

Regional Water Quality Control Boards:

RWQCB-Colorado Basin Region (Indio)	(714)347-4011
RWQCB-Los Angeles Region (Los Angeles)	(213)620-4460
RWQCB-San Francisco Bay Region (San Francisco)	(415)464-1255
RWQCB-Santa Ana Region (Riverside)	(714)684-9330
RWQCB-Central Valley Region (Sacramento)	(916)445-0270
RWQCB-Central Valley Region (Fresno)	(209)488-5116
RWQCB-San Diego Region (San Diego)	(714)286-5114
RWQCB-Central Coast Region (San Luis Obispo)	(805)549-3147
RWQCB-North Coast Region (Santa Rosa)	(707)545-2620
RWQCB-Lahontan Region (Lake Tahoe)	(916)544-3481
RWQCB-Lahontan Region (Bishop)	(714)873-7111
Emergency Water Equipment (Office of Emergency Services, Sacramento)	(916)421-4990
Food and Agricultural Impact (Sacramento)	(916)485-6719
Weather Forecast (SACRAMENTO, 24 HOURS)	(916)447-6941
River Forecasts (Sacramento)	(916)442-1201
Federal Disaster Programs (Farmers Home Administration, Sacramento)	(916)440-3308
Federal Disaster Programs (Agricultural Stabilization and Conservation Service, Davis)	(916)758-5030
Sierra River Releases (DWR, Sacramento)	(916)322-3327
North Coastal River Releases (DWR, Eureka)	(707)443-8467
Delta Tidal Stages and Water Quality (DWR, Sacramento)	(916)445-7571
Fishing Rivers Daily Report (Department of Fish and Game, Sacramento)	(916)452-3564

Reservoir Storages (DWR, Sacramento)	(916) 445-4183 (916) 445-6763
Temporary Water Permits and Diversions (SWRCB, Sacramento)	(916) 322-3737
State Parks and Recreation Areas, Restrictions and Closures (Department of Parks and Recreation, Sacramento)	(916) 445-8828

Governor's Dry-Year Conference

In view of current conditions, the Governor has called a two-day conference for March 7-8, 1977, in Los Angeles to consider the problem. The conference, to which invitations have been extended to federal, state, and local water officials as well as the general public, will have as its specific purpose the exchange of information regarding state and local drought problems, identification of needs which may be met by local, state, and federal programs and increasing public and official efforts to conserve water. Several work group discussions on various topics will be arranged to permit maximum exchange of concerns and for problem solving.

A WARNING ABOUT 1978

Unless conditions improve dramatically within the next several months (and the odds are long against such an occurrence), California will have experienced, back-to-back, two of the driest years of the century. In fact, the combined water totals of the two-year period may well set a record for the driest period of similar duration. Even if 1978 were to bring with it a return to more normal rain and snow, the water supply deficit leading into 1978 would be extremely difficult to erase. Besides the problem of emptied reservoirs, dry watersheds will absorb much of the precipitation and runoff will not be normal even with normal precipitation amounts. Even the shores of reservoirs and the banks of rivers will need to be refilled.

We cannot assume that 1978 will be wet. California has had as many as six consecutive years in which precipitation was below normal. Consequently, we cannot assume that 1977 will be the last dry year in this series. By April 1, 1977, we will know of a certainty what kind of water year 1977 is, but we cannot wait. We must begin now to implement the plans already formulated, and additional ones we may devise, to minimize use and redistribute available supplies in order to maximize carryover into 1978. Even if our hopes are realized and the remainder of the 1977 rainy season brings normal rainfall, we will be required, in 1977, to undergo drastic shortages and to exercise self-discipline to assure necessary supplies for 1978.

If the outlook appears bleak, it is because the situation is indeed serious. Under conditions as severe as those of 1924, we can expect to receive only minimum added inflow to supplement current carryover surface storage.

Most highly populated areas within the State cannot continue "business as usual" during 1977 in view of the possibilities of a dry 1978. Although most metropolitan areas in the southern part of the State have available other sources such as the Colorado River, they can help to ameliorate the disastrous effects upon the remainder of the State by conserving water in their own areas and decreasing the demand upon the depleted resource elsewhere this year and next. All of California's water resources must be considered as to needs in the entire State.

Substantial conservation programs will be necessary throughout the State to prevent drastic shortages in 1978, should dry conditions continue. The water manager who vacillates in the face of current conditions, in the hope that 1978 will be wet, is acting imprudently. Strong action is needed now to head off the almost certain shortage (for many) a year from now. That action now must include mandatory conservation for many of the State's major urban areas as well as many smaller communities.

In the San Francisco Bay region, comprising the counties of San Francisco, Napa, San Mateo, Santa Clara, Alameda, Marin, Solano, Sonoma, and Contra Costa, there are many localities who very soon must face up to this fact, if they have not already done so. They include:

San Francisco	San Leandro	Montara	Novato
Oakland	Albany	Sunnyvale	Sonoma
Berkeley	El Cerrito	Santa Clara	Napa
Hayward	Richmond	San Jose	Vallejo
Fremont	San Mateo	Sausalito	St. Helena
Milpitas	Redwood City	Mill Valley	Calistoga
Newark	Palo Alto	Corte Madera	Petaluma
Union City	Daly City	Larkspur	Santa Rosa
Castro Valley	El Granada	San Rafael	Cotati
San Lorenzo	Half Moon Bay	San Anselmo	

In the Monterey Bay region, similar prospects are in store for:

Santa Cruz	Monterey	Del Rey Oaks
Felton	Seaside	City of Sand
Boulder Creek	Carmel	Pacific Grove
Marina		

Scattered throughout Central and Northern California are dozens more communities that must undergo significant reductions now so that they will have water in 1978.

Other communities, not so drastically affected, must conserve so that their neighbors are not forced to make do with less while water is wasted next door. The larger communities in this category include:

Sacramento	Long Beach	Riverside	Glendale
Fresno	Anaheim	Santa Ana	Garden Grove
Los Angeles	San Bernardino	Pasadena	Huntington Beach

The picture of our water prospects for 1978, as portrayed in this report, is a gloomy one; but the events of next year may be worse even than those pictured. The Department strongly urges that everyone in the State concerned with water management act now to complete contingency plans and prepare to implement strong conservation measures no later than April 1, 1977.

Sections 350-358 of the Water Code, "Water Shortage Emergencies" state:

Section 350:

> "The governing body of a distributor of a public water supply, whether publicly or privately owned and including a mutual water company, may declare a water shortage emergency condition to prevail within the area served by such distributor whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent that there would be insufficient water for human consumption, sanitation, and fire protection."

Section 351:

> "Excepting in event of a breakage or failure of a dam, pump, pipe line or conduit causing an immediate emergency, the declaration shall be made only after a public hearing at which consumers of such water supply shall have an opportunity to be heard to protest against the declaration and to present their respective needs to said governing board."

Section 352:

> "Notice of the time and place of hearing shall be published pursuant to Section 6061 of the Government Code at least seven days prior to the date of hearing in a newspaper printed, published, and circulated within the area in which the water supply is distributed, or if there is no such newspaper, in any newspaper printed, published, and circulated in the county in which the area is located."

Section 353:

> "When the governing body has so determined and declared the existence of an emergency condition of water shortage within its service area, it shall thereupon adopt such regulations and restrictions on the delivery of water and the consumption within said area of water supplied for public use as will in the sound discretion of such governing body conserve the water supply for the greatest public benefit with particular regard to domestic use, sanitation, and fire protection."

Section 354:

"After allocating and setting aside the amount of water which in the opinion of the governing body will be necessary to supply water needed for domestic use, sanitation, and fire protection, the regulations may establish priorities in the use of water for other purposes and provide for the allocation, distribution, and delivery of water for such other purposes, without discrimination between consumers using water for the same purpose or purposes."

Section 355:

"The regulations and restrictions shall thereafter be and remain in full force and effect during the period of the emergency and until the supply of water available for distribution within such area has been replenished or augmented."

Section 356:

"The regulations and restrictions may include the right to deny applications for new or additional service connections, and provision for their enforcement by discontinuing service to consumers wilfully violating the regulations and restrictions."

Section 357:

"If the regulations and restrictions on delivery and consumption of water adopted pursuant to this chapter conflict with any law establishing the rights of individual consumers to receive either specific or proportionate amounts of the water supply available for distribution within such service area, the regulations and restrictions adopted pursuant to this chapter shall prevail over the provisions of such laws relating to water rights for the duration of the period of emergency; provided, however, that any distributor of water which is subject to regulation by the State Public Utilities Commission shall before making such regulations and restrictions effective secure the approval thereof by the Public Utilities Commission."

Section 358:

> "Nothing in this chapter shall be construed to prohibit or prevent review by any court of competent jurisdiction of any finding or determination by a governing body of the existence of an emergency or of regulations or restrictions adopted by such board, pursuant to this chapter, on the ground that any such action is fraudulent, arbitrary, or capricious."

STATE OF CALIFORNIA
OFFICE OF EMERGENCY SERVICES

DIVISION OF UTILITIES

SACRAMENTO OFFICE
P.O. BOX 9577
SACRAMENTO, CALIFORNIA 95823
TEL. GARDEN 1-4990

December 30, 1976

TO: ALL CALIFORNIA WATER UTILITIES

Recent predictions regarding rainfall indicate the current winter and spring season will be deficient in rainfall. Coupled with last year's water deficiencies, such an event adds urgency to the need for all water utilities to plan for an unfavorable level of precipitation and initiate water delivery stretch-out programs without delay. In addition, water utilities whose supply is from wells or runoff catchment reservoirs should investigate possible remedial actions should those sources actually dry up. A checklist of programs to reduce the effects of another dry year is attached.

Unfortunately, the sources of help that may be available to mitigate the effects of a water shortage are limited. Much of the problem stems from the fact that the situation is local in nature and the remedies must be largely from local resources, particularly with respect to the small water utilities. In the order of progression, assistance may be available through the following sources:

a. Self help, planning, rationing and resource management.

b. Mutual-Aid: Neighboring utilities can help one another; e.g., in drilling new wells, lending construction equipment or manpower, making interconnections if possible. But remember your neighbor is also likely to be in trouble.

c. Having exhausted your own remedial resources, the next appeal for help should be to your city or county Emergency Services Administrator.

d. The County will, in an extreme situation, request aid through the State Regional Office of Emergency Services, which office goes, if necessary to the

State Office of Emergency Services. Limited stocks of pipe, valves, pumps, generators, water purifiers, etc., are stored in Sacramento for emergency loans to government entities only, through the Office of Emergency Services. The State also may appeal to federal agencies for assistance. Currently, there is little other than technical assistance available from the federal government. While those governmental agencies will make every effort to help in locating equipment or other resources, it should be realized that alternate water sources must be made available within a reasonable distance of the distressed locale.

The tenor of this letter is pessimistic. The prudent operator will plan and institute programs now to minimize the impact of drought conditions. If assistance is needed, it is most likely to be readily available from nearby water utilities or local government sources. If the need cannot be met there, a further request should be made through Office of Emergency Services channels: Local, regional, and, if necessary, to the State Office of Emergency Services in Sacramento.

Sincerely,

Frank Rothganger

FRANK ROTHGANGER
Utilities Coordinator

Enclosure

CHECK LIST

Programs that might be instituted to reduce the impact of a dry year next year:

What should the water utility do for itself so as to be able to use effective stretch-out techniques and thus avoid harsh experiences such as suddenly running out of water in a specific area:

a. Continuously monitor water inventories in storage as well as in-flow and out-flow rates.

b. Continuously monitor water tables for all wells in relation to the pump depth, static level when not pumping, draw-down while continuously pumping, and recovery time after pumping has ceased. Charting trend curves for all of these values can aid greatly in anticipating trouble and guide decisions as to what should be done, such as to lower pump bowls, drill additional wells, activate rationing plans, and evaluation of the degree of rationing required.

c. Utilities should discuss with their neighbor utilities possibilities for effective mutual aid; such as interconnection possibilities, treatment problems or emergency exchange of manpower, supplies, equipment; etc.

d. Develop specific rationing plans for the whole spectrum of possibilities. These should be discussed with appropriate governmental agencies. Priorities for water use should be defined.

e. Warehouse supplies, pipe, fittings, valves and treatment chemicals should be augmented to meet special contingency situations. Are supplementary stocks of chlorine available? Coagulants? Filtration media? Where can tankers be obtained, including those used for transporting milk, syrup, beer, and other potable liquids? Are there military sources of equipment nearby?

f. Utility employees at all levels should understand how they should meet unusual situations, even those involving security problems.

g. Above all, the public must be fully informed as to why conservation and/or rationing efforts are necessary; cooperation by people is of key importance.

h. Don't allow yourself to use the last gallon of water before appealing for help.

Large water utilities have broad organizational structures that routinely embrace most of the foregoing measures for minimizing the effects of a dry season water shortage. It is among the very small water agencies that drought problems are most likely to be disastrous; the planning measures necessary may have been considered too costly and the alternatives have not been analyzed. Also, much of the essential planning effort may have been deferred in favor of jobs of immediate urgency. Management can, however, stimulate a continuous awareness of possible emergencies and their control.

Article X, Section 2, of the California Constitution and as codified in Section 100 of the Water Code states in part:

> "It is hereby declared that because of the conditions prevailing in this State, the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water."

Section 275 of the Water Code:

> "The department and board shall take all appropriate proceedings or actions before executive, legislative, or judicial agencies to prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water in this state."

Department of Water Resources
P. O. Box 388 Sacramento 95802
(916) 445-8228

WATER CONSERVATION information bulletin

HINTS FOR WATER CONSERVATION

Individuals can:

Install water conservation devices in the home:

- Toilet tank displacement devices such as dams or bottles.
- Low-flow showerheads or shower-flow restrictors.
- Faucet aerators or flow reducers.
- Low water consumption toilets.
- Flow restrictors in garden hoses.
- Low water-using appliances.
- Drip irrigation systems for landscaping and gardens.
- Timers on sprinkler systems.
- Moisture sensing devices to signal need for irrigation.
- Swimming pool covers to reduce evaporation.

Stop leaks. Food coloring can be used in the toilet tank to detect leaks into the bowl; "hidden" leaks can be found by turning off all water faucets, then watching water meter for movement. Leaking faucets should be promptly repaired or replaced.

In automatic washers, wash dishes and clothes with full loads only; when washing dishes by hand, use a dishpan instead of running water; when washing clothes, use the sudsaver, if your machine has such a feature.

Always turn off running water when it is not needed; for example, while brushing teeth or soaping in the shower, cleaning produce or rinsing dishes fill the basin or sink and keep the water until you've finished. Wash autos with a bucket or an automatic shut-off nozzle (and wash cars on lawns where possible to reuse water).

Keep drinking water cold by placing a container in the refrigerator.

When running water to get hot water, save the cold water by placing a bucket under the faucet; use it to water plants.

Use a wastebasket to dispose of bathroom tissues rather than using the toilet.

Water lawns and gardens before 10 a.m. and avoid watering on windy days; mix compost on top of garden soil to increase its water-holding capacity. Place mulch on top of soil around plants to reduce evaporation. Keep the garden weed free. Water less frequently but for longer periods of time when you do. Do not flood your gutter.

Check with local Public Health Department when considering using laundry wash water for lawn and garden irrigation.

Sweep sidewalks and patios; don't use a hose to wash them down.

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Educate family members – especially children – about watersaving practices.

Shower for less than five minutes or – if you prefer – bathe in a quarter-filled tub.

Report evidence of distribution system leaks (water bubbling up through pavement cracks, for instance) to your water company.

Petition your water utility for increasing block rates for water so that higher water users pay more per unit of water.

Insulate hot-water pipes to reduce the amount of water wasted in waiting for hot water.

Consider installing a pressure reducer on the line coming to your home if the pressure is greater than 50 pounds per square inch.

The Small Farmer Can:

Consult with the University of California Cooperative Extension Service about:

- Planting low water-using crops.
- Installing drip irrigation or sprinkler systems.
- Scheduling irrigation for specific crop and soil types.
- Improving drainage.

Eliminate earthen irrigation ditches to reduce leakage.

Control weeds in ditches and in fields to reduce losses. Recycle run-off irrigation water and pump it back on fields.

Small Businesses Can:

Inventory water use in production processes, reduce uses and recycle water where possible.

In restaurants, serve water only on request.

Apply water-saving techniques for landscaping.

Educate employees about water-saving methods.

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WATER CONSERVATION information bulletin

WATER PRICING

To effectively reduce urban water use, the cost of water must be made a significant item in the user's budget or operating expenses, and the user must become aware of the relationship between the quantity used and the cost. The table shows some of the variety of pricing systems used in California, their effect on conservation, and their relative equitability.

In addition to pricing methods, eliminating the assessment of property taxes to cover some water costs and collecting the needed revenue through the water rate structure, and handling sewage treatment charges the same way, would add to users' awareness of the relationship of water use and cost. But attempts to control use by pricing must be carefully thought out to avoid unwanted impacts on the quality of life, on any one segment of society, or on the utility supplier.

Studies indicate that water pricing alone is not aways effective in reducing water use. However, conservation pricing, lifeline rates, inclining block rates, and flat rates have all been used in combination with other factors to reduce use. Other factors influencing use include more restrictive sewer use, educational programs and rationing.

The Department of Water Resources recommends that local water agencies use uniform, peak/seasonal, or increasing block rates. The lifeline rate should be included in the system so all basic needs are met equitably.

In agriculture, where most of California's water is used, pricing systems ideally should return enough money to pay for the water, to be equitable, and to discourage waste. But water pricing for farms also involves questions of public policy. Reduced water prices for agriculture are common among local agencies that deliver both urban and agricultural water.

Increasing water prices could reduce use if farmers changed their irrigation practices, or changed to crops using less water. However, substantial increases might have undesirable results. Some farmers might go out of business. Others, rather than cut water use, might change to higher income crops. Market competition could be affected. Production of low-paying feed and forage crops, which are needed for livestock, might drop. Food prices might rise.

Although such effects must be considered, all means to increase efficiency of water use should be examined and put into effect where they are reasonable and prudent.

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SUMMARY OF PRICING SYSTEMS

Type of System	Definition and Comments	Degree of Equity	Discouragement of Waste
Metering	1. Not generally thought of as a pricing method, it is essential to effect most pricing programs. 2. Installation of meters in nonmetered areas usually results in decrease in consumption of at least 25%. 3. About 90% of California's population resides in metered areas.	Required for Equity	Yes
Flat Rate	1. Usually found in unmetered areas; each customer is charged the same regardless of the amount of water used. 2. Sometimes the rate is varied according to the size of delivery line. 3. Easy for utilities to manage.	Not Equitable	No
Declining Block Rate	1. Customer is charged a certain amount for an initial quantity or "block" of water. The rate for succeeding blocks decreases with each block. 2. Most common rate structure in California.	Not Equitable	No
Uniform Rate	1. Each unit of water costs the same. 2. Second most common rate structure in California.	Equitable	Minor
Increasing Block Rate	1. Customer is charged a certain amount for an initial quantity or "block" of water. The rate for succeeding blocks increases with each block. 2. Rarely used in California.	Equitable	Yes
Peak Load, or Seasonal, Rate	1. Customer is charged a uniform rate for a certain quantity of water. This quantity is usually based on the reduced lawn irrigation season use or on the average demands on the water distribution system. 2. Quantities used above the amounts determined in (1) are charged at a higher rate.	Equitable	Yes
Lifeline Rate	1. State law requires that the rate for a certain amount of energy service ("lifeline" amount) cannot be increased until rates for amounts above the "lifeline" amounts are raised 25%. 2. The City of Los Angeles recently established special water and energy rate categories for certain low income senior citizens. (For water, the first 900 cubic feet consumed each month is discounted 50%.)	Equitable	Yes

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WATER CONSERVATION information bulletin

TOILET DAMMING DEVICES

Toilet dams save water by blocking off part of the toilet tank, requiring less water to fill the remaining part. Savings can range as high as two gallons per flush. These devices do not change the water level when the tank is full thus allowing the flush water to maintain the same effective velocity. A properly installed device can save as much as 5 to 10 percent of the fresh water used within a home. This is a partial list of devices on the market. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any devices have been omitted from the list, the Department would like to be informed. Check your telephone directory or a local plumbing dealer for the devices you want.

C. E. E. Co. Products
P. O. Box 284
Glen Ellen, CA 95442
AQUA MISER
MOBY DIKE

JKW 5000, Ltd.
10610 Culver Boulevard
Culver City, CA 90230
(213) 559-5000
WATER GATE

Econo-Flush
2261 Ritchey Street
Santa Ana, CA 92705
(714) 540-3230

Economizer
18203 Mt. Baldy Circle
Fountain Valley, CA 92708
(714) 963-7864

Eden Enterprises
41 Soledad Avenue
Monterey, CA 93940
(408) 649-3700
WATER GUARD

Nydel Corp.
740 E. Alosta Avenue
Glendora, CA 91740
(213) 335-2231
NYDEL NO. SA-720

Metropolitan Water-Saving Co., Inc.
5130 MacArthur Boulevard, Suite 106
Washington, DC 20016
(202) 363-1980
LITTLE JOHN

Western Water Conservation, Inc.
10880 Wilshire Boulevard, Suite 16
Los Angeles, CA 90024
(213) 879-5252

IMEX Co.
2617 K Street
Sacramento, CA 95816
(916) 446-2763
MINI-FLUSHER

Corporate Office
21241 Ventura Boulevard, Suite 266
Woodland Hills, CA 91364
(213) 999-1440
MINI FLUSHER

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TOILET FLUSH ADAPTERS

Toilet flush adapters save water by mechanically reducing the amount of water used in the cycle. These are mechanical devices which permit the toilet user to vary the amount of water used to flush depending on the material being flushed. This is a partial list of devices on the market. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any devices have been omitted from the list, the Department would like to be informed. Check with a local plumbing dealer for the devices you want.

Fluid Master
1800 Via Burton
Anaheim, CA 92006
(714) 774-1444
FLUID MASTER
(flush valve assembly)

Global American Corp.
1741 South Claudina Way
Anaheim, CA 92805
(714) 533-4401
DUAL FLO
(A manual choice
½ tank or full-tank flush)

R. D. Design
P. O. Box 8734
White Bear Lake, MN 55110

National Water Saver Co.
P. O. Box 14408
Orlando, Florida 32807

Mansfield Sanitary, Inc.
150 First Street
Perrysville, OH 44861
(419) 938-5211
MANSFIELD WATER SAVE VALVE ASSEMBLY
(watersaver valve assembly)

Carlton Industries, Inc.
26701 Via Alcala
Mission Viejo, CA 92675
(714) 540-2270
DIAL-A-FLUSH
(a manually operated
adjustable weighted flush stopper)

Dual-Flo
P. O. Box 8254
Albuquerque, New Mexico

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WATER CONSERVATION information bulletin

LOW FLUSH TOILETS

Toilets use more water than any other fixture in the home. It is estimated that flushing consumes 45 percent of all water used indoors. Low flush toilets which use no more than 13½ litres (3½ gallons) save water by using less water per flush than old-style toilets which use 19 to 27 litres (5 to 7 gallons). Ask your plumbing dealer for specific amounts of water used by each model. This is a partial list of devices on the market. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any low water use devices have been omitted from the list, the Department would like to be informed. Check your telephone directory or a local plumbing dealer for the devices you want.

American Standard
Cadet
2019.016
2020.014

Briggs
Conserver
6270
6271
7280

Crane Co.
Water economy
3-178
3-191

Eljer Plumbingware
Emblem
091-0500

Gerber Plumbing Fixtures Corp.
Water conservation model
21-232

Kohler
Minaqua
K3500-EBA
K3500-PBA

Mansfield Sanitary, Inc.
Water conservation model

Norris Industries
San Mateo
576

Borg-Warner
Artesian
C-4231

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WATER CONSERVATION information bulletin

FAUCET FLOW CONTROLS

Faucet flow controls conserve water by reducing the rate at which water can flow through the faucet. These can be used when faucets put out more water than is needed. They reduce the flow by momentarily reducing the diameter of the water line. Some of the devices can maintain the flow rate in spite of changes in line pressure. Flow rates as high as 30 to 45 litres (8 to 12 gallons) per minute can be reduced to as little as 7¾ litres (2 gallons) per minute. This could save about 4½ percent of house water use. The maximum flow rates are listed for each device, where available. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any devices have been omitted from the list, the Department would like to be informed. Check with a local plumbing dealer for the items you are interested in.

AMERICAN STANDARD
2592.012 -- Aquamizer flow control device, 2.5 gallons per minute (gpm).
1620.012 -- Aquamizer flow reduction device, 2.5 gpm.

DOLE CONTROLS
FMC -- sink faucet control, 1.5 to 4 gpm.
FMA, FMB -- lavatory faucet control, 1.5 gpm.

SPEAKMAN CO.
S4762, S4062 -- Autoflow sink inserts, 2.5 to 4.5 gpm.

KOHLER
2GM -- suffix on Centra and Bancroft stock numbers for watersaving lavatory fittings, suffix on Edgewater and Rockford stock numbers for water-saving sink fittings.

T & S BRASS AND BRONZE WORKS, INC.
B706, B707, B708, B709, B750, B751, B760, B761, B762, B763, B800 -- self-closing faucets.

CRANE CO.
8-2201 -- commercial lavatory spigot, single faucet, 1.5 gpm.

CHICAGO FAUCET CO.
335, 335-E12 -- Tip-Tap slow closing faucets.
615, 616, 617 -- single push-button, self-closing lavatory fittings.
333, 33-E12, 333-slo, 333-slo-E12 -- Naiad push-button self-closing basin faucets.
757-E12, 406-E12 -- Tip-Tap lavatory fittings.
807, 870-E12 -- self-closing lavatory spout with slow closing push-button.

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CHIAGO FAUCET CO. (Continued)
748, 748-335 -- Naiad push-button self-closing angle stop bubbler.
776 -- slow closing self-closing push-button valve.
324, 324-335 -- push-button sink faucet, 2 gpm.
1001, 1002 -- Stedi-flow control valves.

NOLAND CO.
LN-3 -- plastic insert for lavatory and sink faucets, 3 gpm.
LT-3 -- plastic insert for lavatory and sink faucets, copper tube inlets, 3 gpm.

JKW-5000, LTD.
Water gate faucet saver, 2 gpm

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WATER CONSERVATION information bulletin

AUTOMATIC DISHWASHERS

The average automatic dishwasher uses 50 to 61 litres (13 to 16 gallons) for a 60-minute cycle, while some new water savings models use only 28 litres (7½ gallons) for each load. Washing and rinsing dishes under a free flowing stream of water uses as much as 93 litres (25½ gallons). The following are the makes, model numbers, capacities and amounts of water used by automatic dishwashers on the market, so far as we have been able to gather the information. As you can see, the amounts of water used by different makes and models vary widely. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any low water use makes or models have been omitted from the list, the Department would like to be informed. Check your telephone directory or with local appliance dealers for the items you want.

SEARS (KENMORE)
7202 -- capacity 12 place settings, cycle 14 gallons, not adjustable.
7203 -- capacity 12 place settings, cycle adjustable (14 gallons maximum).
7204, 7205, 7206, 7211, 7212, 7213, 7214, 7215 -- capacity 14 place settings, cycle adjustable (14 gallons maximum).

MAGIC CHEF
UD352, MD352, UD152, MD152 -- cycle adjustable from 12 to 15 gallons.

MAYTAG
WU601, WU401, WU201, WC401, WC201 -- cycle adjustable from 13.75 to 16.5 gallons.

O'KEEFE & MERRIT
61-5111, 61-5131, 61-5151 -- capacity 10 place settings, cycle adjustable from 7.9 to 13.1 gallons.
61-5172 -- capacity 12 place settings, cycle adjustable from 7.9 to 13.1 gallons.

TAPPAN CO.
61-1111, 61-1131, 61-1151 -- capacity 10 place settings, cycle adjustable from 7.9 to 13.1 gallons.
61-1172 -- capacity 12 place settings, cycle adjustable from 7.9 to 13.1 gallons.

WASTE KING UNIVERSAL
OSS 950 -- capacity 12 place settings, cycle adjustable from 7.5 to 15 gallons.
OSS 910 -- capacity 12 place settings, cycle adjustable from 12.5 to 15 gallons.
OSS 878, OSS 710, OSS 510 -- capacity 12 place settings, full cycle 12 gallons, not adjustable.

FRIGIDAIRE DIVISION (GMC)
All models -- cycle adjustable from 8.8 to 14.6 gallons.

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KITCHEN AID (Hobart Corp.)
KDW-7, KDA-7, KDC-7 -- capacity 14 place settings, cycle adjustable (12 gallons maximum).
KDC-17A, KDD-67 -- capacity 14 place settings, cycle adjustable (13.5 gallons maximum).
KDS-17A -- capacity 14 place settings, cycle adjustable (14.9 gallons maximum).
KDI-17A, KDR-67 -- capacity 14 place settings, cycle adjustable (15 gallons maximum).

WHITE-WESTINGHOUSE
SU500P, SU700P, SC500P, SC700P -- capacity 14 place settings, "single wash," cycle adjustable from 11.4 to 18.5 gallons per cycle.
SU100P, SU400P, SC100P -- capacity 14 place settings, "single wash," cycle adjustable from 11.4 to 18.5 gallons per cycle.

CALORIC CORP.
2202-1 -- capacity 12 place settings, cycle adjustable (13.2 gallons maximum).
2212-1, 2222-1 -- capacity 16 place settings, cycle adjustable (13.2 gallons maximum).
C222-1 -- capacity 16 place settings, cycle adjustable (14.4 gallons maximum).

ADMIRAL CORP.
DC2456, DC2459, DU2454, DU2459 -- cycle adjustable from 8.8 to 13.2 gallons.

SPEED QUEEN
DC5600, DC5700 -- capacity 12 place settings, cycle adjustable from 7 to 14 gallons.

GENERAL ELECTRIC
GSD251 -- capacity 12 place settings, cycle 16.2 gallons.
All other models -- capacity 12 place settings, cycle adjustable from 11.5 to 16.2 gallons.

HOTPOINT
HDA312 -- capacity 12 place settings, cycle 14.5 gallons.
All other front loaders -- capacity 12 place settings, cycle adjustable from 9.9 to 14.5 gallons.
Top loaders -- capacity 12 place settings, cycle 16.2 gallons.

KELVINATOR
P410L -- cycle adjustable from 15 to 18½ gallons.
P6020L, P8030L, U4015L, U6025L, U8035L, P4010L, -- cycle adjustable from 11½ to 14½ gallons.

GAFFERS & SATTLER
515-1, 615-1, 715-1, P17-1 -- full cycle 13.2 gallons.

GIBSON
SC24C1WG -- full cycle 18.5 gallons.
SU24S7WG -- full cycle 14 gallons.

NORGE
KDP2480A -- full cycle 17.8 gallons.
KEP 2450, KDP 2430, KDP 2420 -- full cycle 13 gallons.

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WATER CONSERVATION information bulletin

LOW VOLUME SHOWER HEADS AND ADAPTERS

Many companies make shower heads and adapters which conserve water by reducing the maximum flow rate or by producing a proper shower spray with a lower flow of water. Since conventional showers use up to 38 litres (10 gallons) a minute and most persons take 5-minute showers, this adds up. Flow control inserts can cut the rate to 11 litres (3 gallons) a minute. This would result in a 70 percent saving of water. The following is a partial list of devices presently available. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any low water use devices have been omitted from the list, the Department would like to be informed. Check your telephone directory or a local plumbing dealer for the availability in your area of any of the devices.

KOHLER
Shower heads:
- Autel K-7371
- City Club K-7351

AMERICAN STANDARD
Shower head:
- Stereo 1414.051

Shower adapter:
- Aquamizer 34626-02

Bath shower transfer unit:
- Heritage 1305.416

MOEN
Shower heads:
- Easy Clean 3900
- Easy Clean Thinwall 3900
- Easy Clean Delux 1533
- Moenflo 3905
- Moenflow Delux 2166

CHICAGO FAUCET CO.
Shower heads with adapters:
- Brownie 620-A, 620-B, 620-C
- Delux 400

NOLAND CO.
Flow restrictor:
- SFC-3

DOLE
Shower heads:
- 2S and 3S

Shower adapters:
- GS, GO and GM

CRANE
Shower head:
- Rivera R8596

NYDEL
Shower head:
- 550-A

ECOLOGICAL WATER PRODUCTS INC.
Shower heads:
- Nova B6402
- Nova B6401

SPEAKMAN CO.
Shower heads:
- Autoflow S2251, S2252, S2253
- Anystream S2245, S2280AF, S2285AF
- Cosmopolitan S2270
- Water Saver S2288, S2300

SLOAN VALVE CO.
Shower head:
- Acto-O-Matic

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SYMMONS ENGINEERING CO.
Shower heads:
4-131-2, 4-131-3, 4-285-2, 4-285-3, 4-282-2, 4-282-3
Control valves:
Shower off 60

WRIGHTWAY MFG. CO.
Shower heads and flow reducers:
SC600 and SC600R

MINUSE SYSTEMS, INC.
Shower systems (special heads, electric motor to mix and diffuse water and air):
MU2000, ½ gpm
MU3000, ¾ gpm
MU4000, 1 gpm

JKW-5000, LTD.
Water gate shower saver, 3 gpm, pressure compensating flow control

Department of Water Resources
P. O. Box 388 Sacramento 95802
(916) 445-8228

WATER CONSERVATION information bulletin

AUTOMATIC CLOTHES WASHERS

These are the makes, model numbers, capacities and water-using features of washers on the market, so far as we have been able to gather the information. The list is not comprehensive, and listing does not constitute an endorsement or a guarantee by the California Department of Water Resources. If any makes or models have been omitted from the list, the Department would like to be informed. Check your telephone directory or with local applicance dealers for the items you want.

WESTINGHOUSE
LA 395, LA 410 -- 14-pound capacity, 4 water levels, 40.3 to 51.3 gallons per cycle.
LA 495P, LA 501P -- 18-pound capacity, infinite adjustments from 40.3 to 51.3 gallons per cycle.
LA 570P, LA 870P -- 18-pound capacity, infinite adjustments from 32.9 to 51.3 gallons per cycle.
LT 100P, LT 170P, LT 570P, LT 870P -- 14-pound capacity, infinite adjustments from 20 to 30.6 gallons per cycle.

WHIRLPOOL
LAC 4500 -- 14-pound capacity, cycle adjustable from 26 to 36 gallons.
LDB 5300, LDA 5300, LDA 7700, LDA 7800 -- 18-pound capacity, cycle adjustable from 27 to 53 gallons.

GENERAL ELECTRIC
Deluxe -- 14-pound capacity, infinite adjustments from 16 to 43 gallons per cycle. 18-pound capacity, infinite adjustments from 16 to 47 gallons.
Standard -- 14-pound capacity, infinite adjustments from 20 to 43 gallons. 18-pound capacity, infinite adjustments from 23 to 47 gallons per cycle.
Portable -- 5-pound capacity, infinite adjustments from 9 to 12 gallons per cycle.

SEARS (KENMORE)
All 14-pound capacity models, cycle adjustable from 26 to 36 gallons.
All 18-pound capacity models, cycle adjustable from 27 to 53 gallons.

ADMIRAL CORP.
All models 18-pound capacity, cycle adjustable from 22 to 49 gallons.

NORGE
LWA 2035 -- 2 to 20-pound capacity, 3 water levels, 25 to 40 gallons per cycle.
LWA 2550, LWA 2075, LWA 2065 -- 2 to 20-pound capacity, cycle infinite adjustments from 25 to 40 gallons.

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KELVINATOR
AW 1800M -- 18-pound capacity, 3 water levels, 22 to 49 gallons per cycle.
AW 1820M, AW 1830M, AW 1840M -- 18-pound capacity, infinite adjustments from 22 to 49 gallons per cycle.

MAYTAG
06 series -- normal capacity, cycle adjustable from 20 to 34 gallons per cycle. Suds saver option saves 16 gallons per cycle.
07 series -- large capacity, cycle adjustable from 20 to 40 gallons. Suds saver option saves 19 gallons per cycle.

FRIGIDAIRE
WCDA -- 16-pound capacity, cycle not adjustable, 42.6 gallons per cycle.
W1 WCD, W2 WIA, W4 W22, WCI -- 2 to 18-pound capacity, infinite adjustments from 28.3 to 49.5 gallons per cycle.

SPEED QUEEN
FA 3530, FA 3590, FA 3591 -- 16-pound capacity, cycle adjustable from 35 to 38 gallons.
FA 6010, FA 6011 -- 18-pound capacity, cycle adjustable from 38 to 42 gallons.
FA 9151 -- 18-pound capacity, cycle adjustable from 38 to 42 gallons per cycle.

HOTPOINT
14-pound capacity model, infinite adjustments from 16 to 43 gallons per cycle.
18-pound capacity model, infinite adjustments from 16 to 47 gallons per cycle.

GIBSON
WA 10D4, WA 10S1 -- 10-pound capacity, cycle adjustable from 20 to 35 gallons per cycle.
WA 18D1, WA 18D2, WA 18D3, WA 18D4, WA 18D6 -- 18-pound capacity, cycle adjustable from 25 to 45 gallons.

MONTGOMERY WARD
All models 20-pound capacity, infinite adjustments from 27 to 52.8 gallons per cycle.

HOOVER
5-pound capacity, 10.5 to 13 gallons per cycle using the suds saver option which saves 10 gallons per cycle.

Department of Water Resources
P. O. Box 388 Sacramento 95802
(916) 445-8228

WATER CONSERVATION information bulletin

HOME LANDSCAPING

Immediate water savings can be gained in times of drought and long-term benefits from water conservation can be acquired through efficient irrigation and horticultural practices. Water use outside the home in California can amount to 40 to 60 percent of the residential use of water. This is roughly 4 to 5.5 percent of the State's total use of water, or over 1,500,000 acre-feet. It is estimated that through excessive landscape watering practices alone 272,000 acre-feet of water were lost in 1972. This amount of water could supply approximately 272,000 households with water for a year.

In a time of drought, voluntary rationing of water is necessary and the urban resident needs to establish priorities for the use of water. If the following conservation measures are practiced, investments made in the urban landscape need not be abandoned, for most plants will have a good chance for survival. At the same time, significant quantities of water can be saved immediately. Remember that **ALL plants need some water.** This information is to help you use the water available to you to the best advantage.

Irrigate to maximize the amount which will reach the depth of the plants' roots. Use of a soaker hose or a drip irrigation system will result in the least surface runoff. The object of watering is to replace the water that is being used by the plant. Too little water applied can be as wasteful as allowing water to runoff and gutter flood. Sprinklers can be good irrigators if they apply water so that it soaks into the soil, are timed to apply the correct amount of water, and are used in the morning to reduce losses to wind and evaporation. Handheld hoses can irrigate effectively only if the person has the patience to soak one spot thoroughly. The U.S. Department of Agriculture Cooperative Extension Service, lists peak water use (evapotranspiration) by turf plants for some selected California areas as follows:1/

AREA	INCHES PER WEEK
Coastal Fog Belt	1.0
Coastal Valleys	1.5 – 1.9+
Delta Region	1.9 – 2.1
Sacramento Valley & San Joaquin Valley	2.1 – 2.4
Desert	2.3 – 3.0

1. To measure the amount of water you are applying if using a sprinkler system, catch the water in straight-sided cans. Note how long it takes to collect a measured amount of water in the can and use this information for timing future waterings. The depth a long, thin metal rod can be pushed into the soil will give an indication how deep the water goes. Avoid wasted runoff by turning the

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1/ W. O. Pruitt, California Turgrass Culture, Vol. 14, No. 4, p 27-32, 1964.

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water off as soon as runoff occurs and wait an hour or two before applying more water. Morning waterings are preferable no matter what irrigation method you use, because of the low evaporation rates at this time.

2. Know what kind of soil you have and how deep it is. Sandy soil loses water most quickly because of evaporation and fast downward percolation. Clay soils offer resistance to the downward movement of water and encourages runoff on the surface. A loam soil with a good sand/clay mixture has the best water retaining properties and requires the least attention for irrigating. Adding compost (decomposed organic materials) is a good way to help improve infiltration and water retention by the soil, although conditioning your soil can take time. Be cautious about disturbing the soil at a time when this could encourage evaporative loss from the soil to the air.

3. A layer of mulch on the ground surface can reduce evaporation significantly, moderate soil temperatures, discourage weeds, and help prevent soil compaction. Mulch can include compost, sawdust, leaves, newspapers, pebbles, and woodchips.

4. Shrubs and trees can be watered infrequently if they are in deep soil and have been watered to their root depths. Encourage the plants by this infrequent watering to extend deeper roots and become less dependent on frequent watering. In many cases established, older plants require only infrequent irrigation but are over-watered nonetheless. Shallow-rooted plants or those in shallow soils need more frequent watering. Turf plants, ground covers, and plants such as camellias and azaleas are notable examples of shallow-rooted plants.

5. Periods of drought are best for gardeners to invest time in the preparation of soil for later plantings. Wait until fall – with the possibility of winter rains along with a generally cooler, humid season to follow – to establish new plants. New plants, even if they are drought-tolerant species, require more water to become established than do most older, established plants.

6. Pull weeds and discourage their invasion, for they compete against the other plants for the available water.

7. Aerating the soil can help water reach the roots and discourage surface runoff. After March, however, aerating may encourage evaporation of water from the soil.

In a drought year, it is desirable to get as much benefit as possible out of what rain does fall in the winter and hold winter irrigation to a minimum. However, if the soil does become dry in the winter, irrigate to maintain soil moisture. The soil should be saturated before spring growth occurs. Establishing a water reserve will help make water more available to plants in the dry season, increase survival rates, and save water in the long run.

Remember that everyone's landscape is different, and the best treatment for your property may be different than a friend's. Think about the type of soil, kind of plants and climate YOU have to work with.

Information on drought-resistant landscapes and gardening is available from the following agencies and organizations. This is a partial list which is constantly being updated with additions because of the increase of public and government involvement. Check with the Resources Evaluation Office of the California Department of Water Resources, P. O. Box 388, Sacramento, CA 95802, for names of individuals in your area with whom you can consult.

LOCAL WATER AGENCIES

Marin Municipal Water District *
220 Nellen Drive
Corte Madera, CA 94925

North County Water District
P. O. Box 146
Novato, CA 94947

Santa Clara Valley Water District **
5750 Almaden Expressway
San Jose, CA 95118

East Bay Municipal Utility District **
P. O. Box 24055
Oakland, CA 94623

GOVERNMENT AGENCIES

State of California **
Office of Appropriate Technology
P. O. Box 1677
Sacramento, CA 95808

Los Angeles County Department of
Arboreta and Botanic Gardens *
301 North Baldwin Avenue
Arcadia, CA 91066

Wayne Roderick *
Regional Parks Botanical Garden
Tilden Park
Berkeley, CA 94720

Joann Jelly **
City of La Habre
P. O. Box 337
La Habra, CA 90631

(Check the phone book under County Offices for Agricultural Extensive Service, Cooperative Extension Offices or Farm and Home Advisors.)

PUBLIC PARKS, GARDENS, ARBORETUMS

Greg Nace **
San Diego Wild Animal Park
P. O. Box 725
East Escondido, CA

Strybing Arboretum Society *
Hall of Flowers
9th and Lincoln
San Francisco, CA 94122

Native Plant Garden
Woodside Library
3140 Woodside Road
Woodside, CA 94062

Dave Verity *
UC Botanical Garden
University of California
Los Angeles, CA 90024

University of California Botanical Garden *
Department of Botany
University of California
Berkeley, CA 94720
(Education Dept. tour: 642-3352)

Dara Emergy
Santa Barbara Botanical Garden *
Santa Barbara, CA 93105

Huntington Botanical Gardens *
1151 Oxford Road
San Marino, CA 91108

John Dourley
Rancho Santa Ana Botanical Garden *
1500 North College Avenue
Claremont, CA 91711

PROFESSIONAL ORGANIZATIONS OF LANDSCAPE ARCHITECTS, NURSERYMEN, GARDENERS, AND BOTANISTS

Saratoga Horticultural Foundation *
20605 Verde Vista Lane
Saratoga, CA 95070

Farallones Institute *
1516 Fifth Street
Berkeley, CA 94710

Cindy Chandler
California Association of Nurserymen
1005 - 8th Street, Suite 304
Sacramento, CA 95814

Sunset Magazine
Willow and Middlefield Roads
Menlo Park, CA

Warren Roberts *
Superintendent of Cultivations
University of California Arboretum
Davis, CA 95616

Richard Pryor, President
California Council of Landscape Architects
(ASLA and American Institute of
Landscape Architects)
120 South Spring Street, Room 4-11E
Los Angeles, CA 90012

California Native Plant Society
2380 Ellsworth Street, Suite D
Berkeley, CA 94704

American Society of Landscape Architects (ASLA)
Northern California Chapter
2451 Potomac Street
Oakland, CA 94602

Dennis Tsuboi, President
ASLA, Central Valley Chapter
4215 Freeport Boulevard
Sacramento, CA 95822

John Hourian, President
ASLA, Southern California Chapter
25281 Ericson
Laguna Hills, CA 92653

ACADEMIC INSTITUTIONS

Robert Perry
Landscape Architecture Department
California State Polytechnic University
3801 West Temple Avenue
Pomona, CA 91768

Richard Harris
Department of Environmental Horticulture
University of California
Davis, CA 95616

Beoff Smith
Horticulture Department
Fullerton College
Fullerton, CA 92634

Russell Beatty
Department of Landscape Architecture
Wurster Hall
University of California
Berkeley, CA 94720

The Biological Sciences and Ornamental
Horticulture Department
California Polytechnic State University
San Luis Obispo, CA 93407

* These organizations are associated with drought-tolerant plants or gardens which can be viewed by the public.

** Drought-tolerant landscape demonstrations are being planned.

ORDER ADOPTING REGULATIONS OF THE
STATE WATER RESOURCES CONTROL BOARD

Pursuant to the authority vested by Section 1058 of the Water Code and to implement, interpret, or make specific Section 275 and Division 2 of the Water Code, the State Water Resources Control Board hereby adopts Section 736.1 of Article 14, Subchapter 2, Chapter 3, Title 23 of the California Administrative Code as follows:

736.1 Hearings in Response to Drought Emergency Conditions. (a) Any hearing held to consider the taking of action in response to drought emergency conditions shall receive calendar priority over other matters pending hearing before the board. This priority shall apply to discretionary hearings, including but not limited to hearings held pursuant to Water Code Section 1428 and hearings held in accordance with Article 17.4 of this subchapter; hearings required by law; hearings required by provisions of board decisions and orders; and hearings held in accordance with the provisions of permits and licenses relating to reserved jurisdiction or continuing authority.

(b) The board shall give notice of any such hearing at least seven days prior to the date thereof. The provisions of Section 733(f) of this article, relating to submittal of proposed exhibits and qualifications of expert witnesses, shall not apply to any such hearing; provided, that the time for submittal of such materials shall be as specified in the hearing notice.

(c) In addition to any other issues specified in the hearing notice as issues upon which the parties should submit information, the parties to any such hearing shall submit information upon the following issues: (1) Existence of a bona fide drought emergency, including information to enable evaluation of the seriousness of the emergency; (2) water conservation measures which have been implemented in the area being served; and (3) availability of alternative sources of water supply, including reclaimed water.

Finding of Emergency

The State Water Resources Control Board finds that an emergency exists and that the foregoing regulation is necessary for the immediate preservation of the public peace, health and safety or general welfare. A statement of fact constituting such emergency is: substantial portions of California are experiencing a second year of greatly below normal precipitation. So that the State Water Resources Control Board may take timely action in response to this on-going drought condition, in cases where a hearing is a required or desirable condition precedent to action, it is necessary that normal hearing procedures be modified. The

changes include announcement that such hearings will be given priority over other matters pending before the Board, that notice of hearing may be as short as seven days, that the Board rule relating to advance submittal of exhibits is suspended, and that certain issues must be addressed at such hearing.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 77-6

ADOPTION OF INTERIM WATER QUALITY CONTROL PLAN FOR 1977
SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH

WHEREAS:

1. It is the responsibility of the State Water Resources Control Board to regulate the activities and factors which affect or may affect the quality of the waters of the State in order to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters, and the beneficial uses involved.

2. It is now clear that 1976 and 1977 will be the most severe two-year drought in California's recorded history. In 1976 below normal precipitation was prevalent throughout the state and by the fall of 1976 many large Central Valley reservoirs had been drawn down to very low levels. By early February 1977, precipitation for this year was less than 30% of normal in most areas tributary to these reservoirs and there is no indication that the current situation will improve.

3. Immediate action must be taken by the State Board to help mitigate the impact of the drought on beneficial uses of Delta waters throughout the State.

4. The schedule for development of the comprehensive long range water quality control plan for the Delta and Suisun Marsh, currently underway, will not allow the Board to consider its adoption until late 1977.

5. The State Board, prompted by severity of the drought and the need to promulgate emergency dry year water quality objectives for 1977, held a special hearing on January 20 and 21, 1977, at which time testimony was received from interested persons on possible measures to mitigate the impact of the drought.

6. The Department of Water Resources and U.S. Bureau of Reclamation have indicated that during 1977 there will be a complete curtailment of surplus water deliveries and that substantial curtailments in delivery of firm contract water will be imposed, if there is no substantial improvement in water supply conditions.

7. The draft interim water quality control plan was distributed for public review on January 27, 1977, and has been revised in accordance with the Board members' comments, as well as appropriate comments received from the public.

8. The adoption of an interim water quality control plan is necessary to help mitigate an emergency and as such is exempt from the requirements of the California Environmental Quality Act (Public Resources Code Section 21,000, et seq.) in accordance with Section 21080 of the Public Resources Code, Section 15071(c) of the State EIR guidelines (California Administrative Code, Title 14, Division 6, Chapter 3), and Sections 2713(c), Subchapter 17, Chapter 3, Title 23, California Administrative Code.

THEREFORE BE IT RESOLVED:

1. That the State Board adopts the Interim Water Quality Control Plan for the Sacramento-San Joaquin Delta and Suisun Marsh in accordance with Section 13170 of the Water Code with the understanding that identified actions set forth in Chapter V are recommendations to be taken under consideration by the appropriate agencies.

2. That adoption of the Interim Plan does not mandate the construction of facilities or mandate activities outside of the State Board's jurisdiction.

3. That the State Board does not intend to affect negotiations among various Delta water agencies and the state and federal governments regarding agreements on water quality and water quantity in the Delta by adoption of the Interim Plan.

4. That the Interim Plan represents the most recent policy statement of the State Board on the Delta and Suisun Marsh.

5. That the Interim Plan includes all necessary elements of water quality control plans in accordance with Sections 13241 and 13242 of the Water Code and federal requirements.

6. That the Interim Plan will be in effect only until the end of calendar year 1977 and supersedes the Basin Plans to the extent of any conflict with specific water quality objectives.

7. That adoption of the water quality objectives in the Interim Plan should not be construed as representing final action by the State Board on water quality objectives for the Delta and Suisun Marsh and that water quality objectives will be modified under the State Board's Phase II hearing on its comprehensive Delta Plan.

8. That the Executive Officer is directed to forward copies of the Interim Water Quality Control Plan to the Environmental Protection Agency in accordance with requirements of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

TABLE 2

INTERIM WATER QUALITY OBJECTIVES FOR 1977
FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH [1]

Beneficial Use Protected and Location	Parameter	Description	Year Type [2]	Values
Municipal and Industrial	TDS	Suspend Basin 5 Plan Objective		
Antioch at water works intake on the San Joaquin River				
Rock Slough at Contra Costa Canal Intake [4]	Chloride	Maximum mean daily	All	250 mg/l
			Sacramento Valley [3] Inflow in Million Acre-Feet	% of the Year 150 mg/l Chloride
	Chloride	Maximum mean daily of 150 mg/l chloride for % of year determined by linear interpolation between values shown. This objective will be suspended if existing salt sensitive industries in the Antioch area are provided a suitable substitute water supply.	5 or less	49
			8	75
			10	82
			15 or more	90
Cache Slough at City of Vallejo Intake	TDS and Chloride	Suspend Basin 5 Plan Objective		
Agriculture				AMJJ / ASOND
Blind Point on the San Joaquin River	EC	Max. 14-day running average of mean daily EC in mmhos	Non-Critical	2.2 / 3.1
			Critical	3.6 / 3.6
Jersey Point on the San Joaquin River & Emmaton on the Sacramento River	Chloride	Maximum 10-day running average of mean daily chloride	Non-critical	1000 mg/l
			Critical Jan./July	1000 mg/l
			Aug./Dec.	1400 mg/l
		Average mean daily chloride for at least 10 consecutive days during the period	Non-Dry or Non-Critical Years	April 1 - May 31 200 mg/l

TABLE 2

INTERIM WATER QUALITY OBJECTIVES FOR 1977
FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH 1/

Beneficial Use Protected and Location	Parameter	Description	Year Type	Values JFM	AMJJ	ASOND
Agriculture Terminous, Rio Vista, San Andreas Landing and Clifton Court Ferry	TDS	Maximum 10-day running average of mean daily TDS in mg/l	Normal or above	700	700	700
			Below Normal	700	700	800*
			Dry or Critical	700	800*	800*
	TDS	Average of mean daily TDS for any calendar month in mg/l not to exceed	Normal or above	500	500	500
			Below Normal	500	500	600*
			Dry or Critical	500	600*	600*
	TDS	Average of mean daily TDS for any calendar year in mg/l not to exceed	Normal or above	450	450	450
			Below Normal	450	450	500*
			Dry or Critical	450	500*	500*
* The TDS value at any of these four stations may reach but not exceed the stated values, provided the average of the TDS value at the four stations not to exceed the adjacent unstarred value						
Green's Landing on the Sacramento River	TDS (Modifier of above standard)	Maximum 10-day running average or mean monthly	All	150 mg/l		
		Whenever this station exceeds 150 mg/l TDS the standards above (interior Delta) may be changed by adding to those values the product of 1½ times the amount by which the recorded TDS at Green's Landing exceeds 150 mg/l				
San Joaquin River at Vernalis	TDS	Maximum running 30-day average of mean daily TDS	All	500 mg/l		
Eastern Delta Channels	TDS	Maximum mean monthly	All	700 mg/l		
Fish and Wildlife Striped Bass Spawning Prisoners Point on the San Joaquin River	EC	Average of mean daily EC for the period not to exceed	All	April 1 to May 7 550 umhos		

TABLE 2

INTERIM WATER QUALITY OBJECTIVES FOR 1977
FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH[1]

Beneficial Use Protected and Location	Parameter	Description	Year Type	Values
Fish and Wildlife				
Striped Bass Spawning				
Chipps Island	Delta Outflow Index at Chipps Island in cfs	Average of the daily outflow index for the period not less than	All	April 1 to April 14 - 6700 cfs
Antioch Waterworks Intake on the San Joaquin River	EC	Average of mean daily EC for the period not more than	All	April 15 to May 7 1500 umhos
Chipps Island	Delta Outflow Index (replaces the above Chipps Island and Antioch objectives whenever project users are taking deficiencies in firm supplies)	Average of the daily outflow index for the period not less than	All - whenever project users are taking deficiencies in firm supplies	April 1 to May 7 6700 cfs - $\frac{(D)}{(7000af)}$ 100 cfs D is 37/365 of deficiencies of annual firm supplies in acre feet taken by project users, excluding Friant Division of the CVP
Striped Bass Survival[5]				
Chipps Island	Delta Outflow Index at Chipps Island in cfs	Average of the daily outflow index for each period shown not less than	Norm. or above	May 8-31: 14,000; June: 9,500; July: 6,50
			Below Norm.[3]	11,400; 9,500; 6,50
			Sub-average Snowmelt	6,500; 5,400; 3,60
			Dry or Critical	3,000; 2,500; 2,50

TABLE 2

INTERIM WATER QUALITY OBJECTIVES FOR 1977
FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH 1/

eneficial Use Protected and Location	Parameter	Description	Year Type	Values
ish and Wildlife				
Suisun Marsh				
Chipps Island at O&A Ferry Landing 6/	EC	Maximum 28-day running average of mean daily EC		Oct. - May
			Normal or above	12.5 mmhos
			Below normal	12.5 mmhos
			Dry or Critical	15.6 mmhos

/ Except for flow, all values are for surface zone measurements.
Except for flow, all mean daily values are based on at least hourly measurements.
All dates are inclusive

2/ Shasta Inflow water year type as defined in Basin 5B Plan, except as noted.

3/ Based on Sacramento Valley inflow as defined on Pages 21 and 22 of DF&G prepared statement on January 20 before the State Board.

4/ TDS objective suspended for 1977.

5/ Supersedes Chipps Island chloride objective in the Basin 2 Plan.

6/ Supersedes Suisun Marsh objectives in the Basin 2 Plan.

Assembly Concurrent Resolution No. 16 (adopted February 1977)

WHEREAS, Existing drought conditions are causing substantial and increasing hardships and crises in many areas of the state; and

WHEREAS, The drought has left our reservoir water levels seriously low; and

WHEREAS, The continuation of this severe drought could threaten urban water supplies and thereby affect employment and economic stability in California; and

WHEREAS, The immediate implementation of water conservation would permit substantially larger amounts of water to be retained in municipal reservoirs as effective insurance against an extended drought, and, in certain areas, would permit increased amounts of scarce water supplies to be used for necessary food production; and

WHEREAS, Most of the authority to initiate water conservation rests with a variety of local government agencies; now, therefore, be it

Resolved by the Assembly of the State of California, the Senate thereof concurring, That all such local governmental agencies are requested to immediately evaluate their local water supplies and needs through October 31, 1978 as a minimum and to institute, as soon as possible, all appropriate water conservation methods that would assist their own area as well as other areas which could be thereby benefited; and be it further

Resolved, The the Department of Water Resources is requested to provide technical assistance to public agencies in evaluating water supplies and demands and in implementing water conservation programs; and be it further

Resolved, That those water conservation methods which should be considered, among others, include the following:

(1) Educating consumers on conservation, to raise the public's level of awareness on the importance of not wasting water.

(2) Establishing anti-gutter-flooding programs.

(3) Retrofitting existing bathroom showerheads with low-flow showerheads or with flow restrictors.

(4) Retrofitting bathroom toilet tanks with plastic bottles or rubber or plastic "dams".

(5) Initiating leak detection programs.

(6) Washing cars with a bucket instead of a hose.

(7) Encouraging water users not to wash off sidewalks with a hose.

(8) Installing timers on sprinkler systems.

(9) Incorporating moisture sensing devices into automatic sprinkling systems to determine whether sprinkling is needed.

(10) Not watering during the heat of the day and not watering on windy days.

(11) Installing aerators on sink taps.

(12) Detecting leaks in toilets by putting food coloring in the tank and watching for coloration of the bowl.

(13) Using a dishpan when washing dishes by hand.

(14) Shortening shower time.

(15) Insulating hot water pipes in order to shorten the wait for hot water.

(16) Providing technical assistance to water using industries encouraging the conservation and reuse of water.

(17) Having restaurants serve water only on request.

(18) Encouraging farmers to plant low water using crops.

(19) Encouraging the installation of drip irrigation systems.

(20) Replacing flood irrigation with sprinkler irrigation.

(21) Encouraging the use of water meters; and be it further

Resolved, That a copy of this resolution be transmitted to the board of supervisors of each county, to the city council of each incorporated city, to each public agency which supplies water, and to the Department of Water Resources.

EXAMPLES OF URBAN PER CAPITA WATER USE THROUGHOUT CALIFORNIA

Gallons per Capita Per Day[1/]

HYDROLOGIC STUDY AREA	WATER USE*		WATER USE*
NORTH COAST			
Arcata	115	Rio Dell	74
Crescent City	126	Ukiah	231
Eureka	135	Willits	177
Fort Bragg	186	Yreka	195
SAN FRANCISCO BAY			
Antioch	169	Novato	165
Belmont	143	Pacifica	98
Daly City	108	Petaluma	145
Hayward	148	Pittsburg	159
Healdsburg	273	Rohnert Park	194
Hillsborough	279	San Francisco	147
Livermore	143	San Jose	164
Milpitas	167	San Mateo	144
Most Marin Co. cities	173	Santa Rosa	161
Most Western Alameda County Cities	204	Southeast Contra Costa County Cities	236
Mountain View	194	Sunnyvale	167
Napa	200		
CENTRAL COAST			
Arroyo Grande	137	Lompoc	121
Atascadero	230	Montecito	406
Carpenteria	182	Monterey Bay Cities	152
Carpenteria - (outside)	442	Salinas	152
El Paso De Robles	315	San Luis Obispo	157
Goleta	139	Santa Barbara	166
Hollister	148	Santa Cruz	175
King City	232	Santa Maria	194

EXAMPLES OF URBAN PER CAPITA WATER USE
THROUGHOUT CALIFORNIA (Continued)

Gallons per Capita Per Day[1/]

HYDROLOGIC STUDY AREA	WATER USE*		WATER USE*
SOUTH COAST			
Alhambra	162	Monterey Park	153
Anaheim	219	Oceanside	241
Arcadia	287	Ontario	257
Beaumont	248	Orange	176
Beverly Hills	353	Oxnard	162
Burbank	248	Pasadena	223
Corona	288	Pomona	288
Downey	152	Porte Hueneme	223
Escondido	179	Redlands	289
Fillmore	214	Rialto	240
Fullerton	272	Riverside	235
Garden Grove	161	San Bernardino	234
Glendale	158	San Diego	179
Glendora	225	Santa Ana	183
Hemet	178	Santa Monica	171
Hermosa-Redondo	145	Santa Paula	182
Huntington Park	122	South Bay (San Diego)	
Inglewood	145	Cities	125
Long Beach	161	South Gate	171
Los Angeles	179	Upland	247
Manhattan Beach	129	Ventura	237
SOUTH LAHONTAN			
Big Pine	1,457	Mammoth	356
Bishop	538	Mojave	335
Independence	1,363	Victorville	311
Lone Pine	946		
COLORADO DESERT			
Blythe	425	El Centro	292
Coachella	202	Palm Springs	552
NORTH LAHONTAN			
Alturas	256	Susanville	223

EXAMPLES OF URBAN PER CAPITA WATER USE
THROUGHOUT CALIFORNIA (Continued)

Gallons per Capita Per Day[1/]

HYDROLOGIC STUDY AREA	WATER USE*		WATER USE*
SACRAMENTO BASIN			
Chico	358	Paradise	405
Colusa	324	Red Bluff	492
Corning	307	Redding	310
Davis	242	Sacramento	295
Gridley	327	Woodland	360
Marysville	295		
SAN JOAQUIN BASIN			
Merced	406	Stockton	237
Modesto	370		
TULARE LAKE			
Bakersfield	380	Lindsay	340
Clovis	226	Porterville	205
Delano	392	Selma	360
Fresno	342	Tulare	341
Hanford	314		

[1/] One gallon equals 3.7854 litres.

*Urban per capita water use is the quantity of water used directly or indirectly by individuals within a specified geographic area. It includes all urban uses of water assigned to the resident population of the area. The values shown above were calculated by dividing the total water use of a community during a period of time by the number of persons living there. The rate is based on gross water delivered into water agency systems and includes total amount produced and delivered to customers, losses inherent in a system such as conveyance leakage, back flushing of a filter system, fire protection requirements, and any unaccounted for losses.